January 1960

Agriculture

Volume LXVI Number 10

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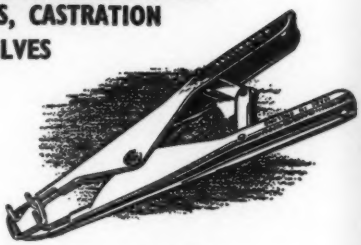

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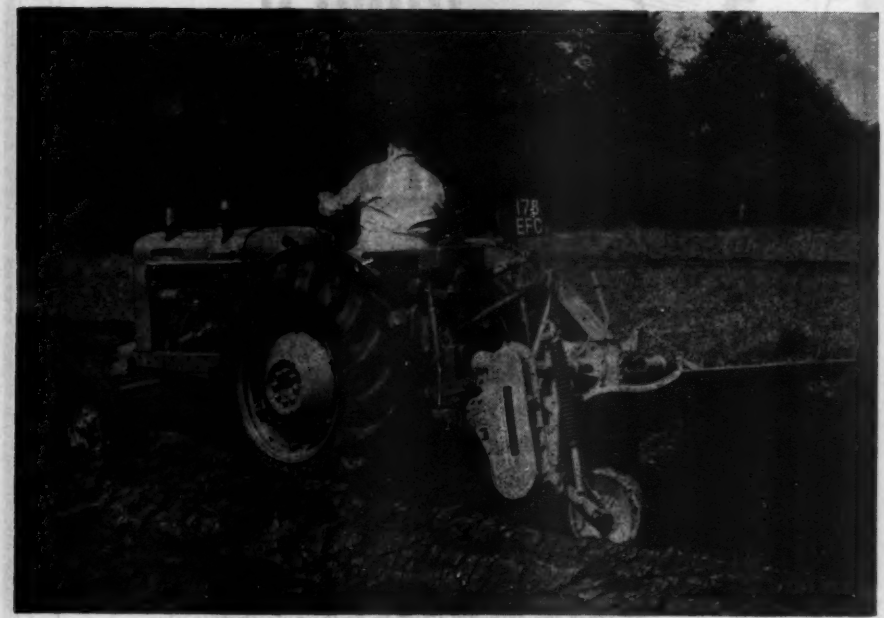

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Agriculture

Volume LXVI Number 10 January 1960

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Cover photograph: Hedge-laying on an East Anglian farm *Photo: Mustograph*

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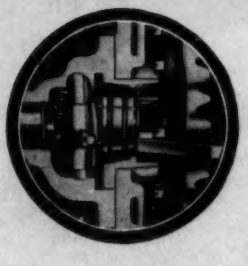

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Sixty Years of Saxmundham

2. Problems still Unsolved

SIR E. JOHN RUSSELL, O.B.E., D.SC., F.R.S.

Like all useful experiments, those at Saxmundham have raised more problems than they have solved. Some of the most important centre round the relation between the phosphatic fertilizer, the soil and the plant. Part 1 of this article appeared in last month's issue of AGRICULTURE.

UNTIL quite recently it has been commonly supposed that only about a quarter of the phosphate supplied in the fertilizer is recovered in the crop, the other three-quarters being absorbed by the soil—piling up almost uselessly. Unfortunately, the amount recovered cannot be measured at Saxmundham because there are no analyses of the crops, nor have samples been kept. Analyses cannot be made now, but there is another way of dealing with the problem. We know that little, if any, phosphate is washed out of a calcareous soil by the rain; whatever is added in the fertilizer is either in the soil or in the crop. We can be quite sure that Oldershaw and Cattermole applied the right quantity of the fertilizer every year without fail, and that the sum of the dressings of these sixty years gives us the true total supplied; we can compare this with the quantity left in the soil, and the difference represents the amount which the crop obtained.

This has been done at Rothamsted by Doctors Cooke and Mattingley, and it has led to the unexpected result that the recovery at Saxmundham is considerably higher than the generally accepted 25 per cent. Is this because the general estimate is wrong, or is it correct and the Saxmundham soil exceptional? There are grounds for thinking that the old estimate may be too low: some of the phosphate fixed in the soil, which we used to regard as unavailable, may be available after all. The question needs fuller investigation, and the Saxmundham plots furnish excellent material for the purpose, for during the sixty years the treated ones have received 6 tons of super per acre, in sixty annual doses of 2 cwt, each well spread and worked into the soil.

The question is much more complicated than that, however. Atomic science has been pressed into the service of agricultural research by the agricultural chemists, and it has enabled them to distinguish between the

To all our readers—

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New Year

phosphate in the plant that has come from the soil, and the phosphate that has come from the fertilizer. This shows that the addition of superphosphate to the soil liberates some of the supposedly unavailable soil phosphate, so that the plant gets more from the soil than it had done before, but less from the fertilizer than we used to think. It is hard to understand why a part of the phosphate from the fertilizer, instead of following the rest of it into the plant, should release some of the unavailable phosphate of the soil to the plant, and itself become apparently unavailable. But Nature does these puzzling, roundabout things.

Another problem that needs further investigation is the relative value of the phosphate in farmyard manure and in superphosphate. FYM phosphate has always been supposed to have only about three-quarters of the value of superphosphate; this is the figure used in Hall and Voelcker's tables for compensation for unexhausted manurial value. But the Rotation 1 results suggest, though they do not prove, that there is little if any difference between them. Here also the plots provide valuable material to the chemist studying the problem.

Losses of nitrogen

The plots also give useful material for studying the mechanism of the losses of nitrogen and organic matter from the soil. Unfortunately the actual losses up to the present cannot be determined with certainty, because of insufficient data about the soil at the beginning of the experiments. But a great deal of information can be obtained. Whatever the losses of nitrogen and organic matter from the soil may have been, the losses of nitrogen from the farmyard manure have been heavy: during the sixty years the manure had added nearly 5,000 lb of nitrogen per acre, yet at the end of the time, in spite of some good crops of clover, the soil contained only 1,500 lb per acre more than the plot which from the beginning has had no manure or fertilizer. Not all the nitrogen is lost, however; some has gone into the crop. Now the crop differs little from that given by complete artificials, supplying less than half the nitrogen carried in by the manure: 2,100 lb in all, or 35 lb a year. The crops in the dunged plot are probably richer in nitrogen than those receiving fertilizer only, but they have also had larger crops of clover to draw upon.

It may not be far wrong to say that the 35 lb of nitrogen per acre supplied by the nitrate of soda has been about as effective as the 80 lb nitrogen supplied by the farmyard manure: that is, the nitrogen in farmyard manure is only about 45 per cent of the value of nitrogen in nitrate of soda. As a source of nitrogen for crops, 1 cwt of nitrate of soda has thus been about as good as 3 tons of farmyard manure. This is very much the same figure as has been obtained elsewhere; it is one of several checks that can be applied to the Saxmundham results, and every time the results come out from the test satisfactorily.

This loss of nitrogen from farmyard manure in the soil is a serious matter and needs much fuller investigation.

The plots can give useful information on another important subject. The soil on the farmyard manure plot is distinctly in better condition than on the others: it can be worked earlier and more easily in the spring, and it holds more water—a good thing in a dry season, but not in a wet one.

Dr. Boyd has studied the effect of rainfall on the crop yields. Although this part of Suffolk is usually regarded as a dry region, he finds that the average rainfall, about 23·7 inches a year, is higher than is good for the crops: each additional inch of rain over the average reduces the mangold crop by about a quarter of a ton per acre, while each inch below the average raises it by the same amount. Barley also suffers in the same way; so does wheat, but to a lesser extent. These rainfall studies may yet have practical value. Some progress has already been made towards bringing rain in a dry spell to a region where it is wanted, though no one has yet been able to think of a way of making the rain stop when you have had enough of it.

Higher yields

There is another direction in which these plots will provide valuable material for much needed investigations. Economic and social necessities are compelling us to increase greatly the output from our soil. When these experiments began, a farmer could reasonably be satisfied with a yield of 30 bushels of wheat (about 16½ cwt) per acre; now our average is over 20 cwt, and a good wheat grower will expect 35 cwt: many get 2 tons an acre, and 3 tons and more have been obtained on experimental plots. This, of course, has been the result of combining many improvements: quicker cultivation and other operations which enable full advantage to be taken of the weather best suited to them, more prolific varieties of crops and better control of pests, diseases and weeds, and also much greater use of fertilizers, which are themselves greatly improved. Sixty years ago, farmers in the United Kingdom were supplying about 130,000 tons of plant food a year, mostly phosphate: last year the quantity was over a million tons. In those early days potassic fertilizers were hardly used at all; now we use more than 700,000 tons a year, supplying about 370,000 tons of plant food. Broadly speaking, we are using eight times as much fertilizer as we did then, and it is better balanced. So far as we can see, this increasing use of fertilizer is bound to go on, for our population is increasing, people are able to buy abundant food if they choose to spend their money that way, and our farmland is steadily decreasing in area. Since these experiments began, we have lost about a million acres of farmland to housing, for factories, roads, airfields, sports grounds, service requirements and a variety of other purposes that produce no food whatsoever, and although the gardens attached to the new houses produce a certain quantity of fruit and vegetables, they provide neither bread, butter, cheese, milk nor meat. All these have to come out of our shrinking area of farmland. There has been a corresponding shrinkage in the labour force, yet in spite of loss of land and workers, British farmers are now producing more food than they did when these experiments started. Moreover our soils are in better heart. Our yields are still increasing and must go on doing so, but that means steady, continuous improvement in the means of production and a steadily growing use of more productive methods.

Plant food and the seed

Some anxiety has been expressed as to whether our high consumption of fertilizers is detrimental to the quality of the crops; whether foods produced

in this way are as nutritious as those grown with less fertilizer; whether indeed they may possess some harmful quality. I know of no good evidence of any harm so far as food value is concerned, though for special purposes such as high malting-quality in barley the fertilizer dressings should not put too much nitrogen into the grain. But it is a fair question, and it is linked with the more general one of what is the effect of shortage of any of the essential plant foods on the plant and on its seed? On this question the plots can furnish thoroughly reliable material for investigation. The work would have to be done in a well-equipped physiological laboratory, on strictly scientific lines, with complete impartiality, and no suggestion of bias one way or the other. So far as the seed is concerned, some experiments at Aberystwyth showed that the seed of a plant insufficiently supplied with phosphate did not produce as good plants as when the phosphate supply was adequate. Would this be true of important crops like wheat, barley or beans? We always used to think that, apart from the quantity produced, the nature of the seed was not much affected by any shortage of plant food to the parent. It would produce less seed if it had suffered a shortage of food, but the seed itself would be much the same in character, and would produce much the same kind of plants, whether it had been raised on poor soil or good. The plants grown on the Saxmundham soils would provide useful material for a critical test.

It is safe to say that the plots will prove more and more useful to agricultural teachers and scientists as time goes on, and the effects of withholding the various elements of plant food show up more and more strikingly. You may tell a Young Farmers' Club what are the effects of nitrogen, phosphate and potash on the growing crop, but here the members can come and see for themselves. The agricultural teacher and adviser can note the symptoms produced by the various shortages, so that they can recognize them when they see them elsewhere.

It would be easy to draw up a list of other scientific problems for which these plots give valuable material. There is also the possibility that a team of workers might be collected which would be able to do the work. As you all know, there is a proposal to establish a University in the Eastern Counties. This ought to be done and I sincerely hope it will be. Whenever that happens, it must have a strong agricultural side where good research work in agricultural science is being done. These experiments would furnish both the problems and the material for solving them. Help on special problems would certainly be forthcoming from Rothamsted and Cambridge.

What practical benefits might one expect to result from a full scientific study of this material? It is quite impossible to say. Science and practice are close relations, but independent of each other. Before an important practical result emerges from scientific investigations, there have had to be scientific discoveries in many directions, and until they are all done and linked up, the practical application cannot be made to work on a farm although it may look all right in an experimental station. It is quite usual for sixty years to have passed between the birth of the idea and the finished product that the farmer can use. Even then the new product may only slowly be taken up. How our farm workers at Rothamsted hated their first tractor!

At present the technological chemists are having a wonderful innings. They have produced conditioners for improving soil tilth, and numerous

marvellous agents for controlling insect pests and diseases of plants and animals, and for destroying weeds in crops and pastures. Engineers have speeded up cultivations, harvesting, milking; almost every operation is done far more quickly, and in general more efficiently, than formerly, and done with less labour. That will continue. Even crops and animals are now being caught up in the speed and efficiency campaign. Chemists have produced antibiotics that increase the efficiency of foods, and hormones that hasten the growth of animals; also the new chelates that facilitate the entry of nutritive elements into the roots of plants. Physiologists have already got hormones that will produce more twins, and they have long since made artificial insemination an everyday operation for farm cattle. When you think of that American bull that is credited with 118,000 calves, it is easy to see that bulls are on the way to becoming rarities seen only at a few approved veterinary centres and in zoological gardens. It may be that one of Mr. Trist's* successors will have to organize journeys to Whipsnade to show a Red Poll bull to some future Suffolk Young Farmers' Club.

1,700 calves per cow

Still more remarkable results will follow if and when it becomes possible to remove 1,500 or 1,700 fertilized ova, each a potential calf, from a high-class cow, transfer them one by one to common cows where each will develop and at the appointed time emerge as a high-class calf, the image of its true parents and untainted by the incubator mother. So the high-class cow could yield a colossal progeny, though not as many as the bull. This transfer has been effected for rabbits and sheep, and it may at any time be achieved for cows: already some American optimists are said to be looking forward to the time when these fertilized ova will be sold in packets ready for use on the farm, enabling a prize herd to be produced from a scrub lot of cows in one season.

Atomic science is the latest recruit to come into the service of agriculture. It has already been used for producing new varieties of crops, and is beginning to be used for controlling operations. Last autumn, on the Reading University farm, a tractor worked by internal electronic control and without any human intervention followed its prescribed course, obeyed traffic lights, threw off its bales of hay at the proper places and stopped when its work was done. The next development, and already it seems feasible, is for the tractor to leave its shed at the appointed time in the morning, do its allotted day's work, and go back in the evening when its various tasks are over—without any need for the farmer to bother about it. As they become available and practicable, new appliances must be adopted in order further to increase the efficiency of our agriculture; they will lighten the manual work, but they will not diminish the farmer's worries. Like other improvements, they will probably only mean changing one set of worries for another. But they will demand high standards of education and mental agility, enabling the farmer to discriminate between the many new appliances offered to him and choose only those best suited to his conditions.

---

* County Advisory Officer for Suffolk.

Electronics and Farm Planning

CHRISTOPHER S. BARNARD, M.A.
and
BRIAN M. CAMM, B.SC.
School of Agriculture, University of Cambridge

Electronic computors can make farm planning much more flexible. They are able to take account of a far greater range of alternatives than could conveniently be tested by budgeting.

ELECTRONIC computors are playing an increasingly important role in many industries. Have they any contribution to make to agriculture? In the realm of farm planning, at least, they have already begun to prove their value, and are likely to do so increasingly in the future. While this does not imply that farmers will become mere "button pushers" with a computor to do their thinking for them, it does mean that these machines can help to answer some of their problems. This is possible through the medium of a mathematical technique known as "linear programming".

For some years now, agricultural economists and advisory officers have made use of budgetary analysis when planning changes in farm organization. From time immemorial it has been used informally, and perhaps subconsciously, by farmers. Essentially, a budget assesses the financial implications of some proposed course of action or technological change. Unlike farm accounts, it looks forwards and not backwards. Budgets can help to reach decisions on various aspects of farm policy, such as the selection of enterprises that will give the best return, the choice of the most paying technique to use in a particular enterprise, or the determination of the most profitable level of production within an enterprise.

The amount of information required in a budget necessarily varies with the nature and magnitude of the changes being considered. When the whole farming system is being reorganized, answers are needed to the following questions:

1. What resources has the farmer at his command, and which are likely to restrict economic expansion on the farm—such as scarcity of labour at harvest, lack of capital to install a milking parlour, or lack of yard space for expanding a dairy herd?
2. What range of crops and livestock can the farmer produce, and what resources do they require—such as hours of labour, cwt of fertilizer or gallons of tractor fuel, and what yields may be anticipated from them?
3. What prices can the farmer expect for the produce he sells, and what are the prices of the various inputs he buys?

Why use linear programming?

Linear programming needs precisely the same information, and aims at answering the same problems as those tackled by budgeting. What advantages has it to offer, therefore, over the use of budgeting? In fact for many smaller problems budgeting remains the more suitable technique, but in

larger problems linear programming on a computor offers several advantages.

Perhaps the most outstanding is that linear programming brings a much greater flexibility to farm planning, because it permits account to be taken of a far greater range of alternatives than could conveniently be handled by budgeting. Thus, for example, it allows several different methods of producing each crop and livestock to be considered, at the same time as selecting the proportions in which they should be carried. Or, again, it can take account of labour requirements and availabilities at all seasons of the year, a task which, if budgeting were used, would be tedious in the extreme.

This greater flexibility is well illustrated by reference to a study made five years ago of a representative small arable/dairy farm in Suffolk.* Here the aim was to find how much improvement in farm profit was possible solely from a re-arrangement of cropping and livestock, with no changes in techniques, yields or the amount of capital available. (The range of crops and livestock available is shown in the left-hand column of the table.) If this

Organization of a Suffolk farm

	Actual organization *acres*		Suggested organization *acres*	
Wheat	16		19½	
Barley	16		13	
Oats	7		—	
Peas	—		8	
Beans	6		—	
Sugar beet	4½		5	
Mangolds	2		2½	
Ley	6½		7½	
		58		55
Pasture		23		26
		81		81
Dairy cows (and young stock in proportion)		14		16
	£		£	
Total receipts	4,045		4,680	
Costs	3,248		3,682	
Net income	797		998	

problem were tackled by budgeting, it would be necessary to set up several fairly *rigid and preconceived* alternative plans—one perhaps testing the effect of an expansion of the cash crops, another an expansion of the dairy herd, and another the substitution of peas for some of the existing cash crops. Linear programming is not tied down in this way but can consider all these plans—and hundreds of others—simultaneously because, within certain limitations that are laid down to ensure a feasible farm plan,† the computor

* See *Resource Allocation on an East Anglian Dairy Farm* by C. S. Barnard and V. E. Smith. Occasional Papers No. 6, Farm Economics Branch, School of Agriculture, Cambridge.

† For example, rotational restrictions to ensure that crops are not grown in proportions that violate the dictates of good husbandry.

is free to choose whatever is the best combination. The solution (in the right-hand column of the table) in fact shows itself as a subtle amalgam of changes, with both the dairy herd and cash crops expanding together.

At the same time this brings out another important advantage, in that the computor selects from a mass of alternatives the one plan that gives the maximum profit—or whatever particular end is sought.* In the example farm, profit rises from £797 to £998, an increase of £201. No other plan will make as much profit under the conditions specified. If budgeting were used, and perhaps half a dozen plans tested, the one that gave the greatest return would be selected as the basis of the future farm plan, although it would be most unlikely that this would coincide with the best solution actually possible.

Yet another advantage is that the solution obtained through linear programming, by showing which particular resources have run short, focuses attention on adjustments that may be desirable before the plan is put into effect. In the example farm, further development was halted because all available October labour was used up, mainly because of the high labour requirements of harvesting sugar beet and mangolds, coupled with the extra attention needed by cows transferred from grazing to lying-in. Possible ways of overcoming this labour shortage would be by using a harvester on the sugar beet, by substituting grass silage for the mangolds or by extending the grazing season. In addition, the solution shows by how much revenue would increase if it were possible to obtain an extra unit of a resource that has been fully used. In the instance just quoted, an additional hour of October labour would enable £1 16*s.* more revenue to be made, so the farmer could afford to make fairly strenuous efforts to overcome this particular bottle-neck. On the other hand, an extra ton of straw (all available straw was used up by the dairy herd) would only bring in 12*s.* additional revenue, so even if a neighbour allowed the farmer to pick up the straw for nothing, it would hardly pay for the effort involved.

Testing plans against future changes

A further valuable feature of linear programming is that it is possible, by calculating how much prices must change before the solution should be adjusted, to test its stability in a changing economic environment. It is also quite feasible to proceed a stage further and calculate what the adjustments should be, on the assumption that prices have changed by an amount sufficient to warrant a new programme. In this manner it becomes possible to advise farmers not only on what may be the best organization for their conditions, but also how they ought to react to future price changes. For instance, in the example farm, milk prices would need to rise by 18 per cent (other prices unchanged) before there would be any advantage in expanding the size of the dairy herd.

Linear programming may well solve a problem more quickly than budgeting. Given that similar data is needed in both methods, and assuming that this has already been collected, setting up the data for the computor need only take a few hours, and running the problem through it as little as two

* Rather than maximum profit it might be a given income with the maximum leisure, or the maximum income concomitant with the least risk.

seconds! Also, in budgeting it is often necessary to construct first a "trading" budget to discover whether a proposed change will prove worth while, and second a "capital" budget to discover whether enough money is available to put the plan into operation; in linear programming, these two stages can be carried out simultaneously by the inclusion of suitable capital restrictions.

How is linear programming likely to develop?

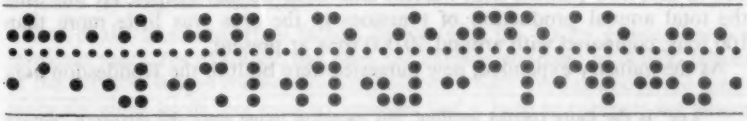
Provided that a farmer can supply the necessary data, it is quite feasible to programme an individual holding. An example of this is provided by a Cambridgeshire farm, where the problem was to determine the best balance between the arable and a dairy herd. The farmer wished to introduce self-feed silage and a milking parlour and to expand his dairy herd. His landlord was uncertain whether this would justify the additional capital expenditure. Linear programming showed that on the farmer's present rate of stocking of grassland (which was below average) the landlord was right, and far from expanding the dairy herd, its size should be reduced. On the other hand, if the farmer tightened up his grassland management and achieved an average rate of stocking, then expansion of the dairy herd would be fully justified.

However, perhaps this is tending to look into the future. At present, while there are masses of farms and farming problems, there is a dearth of computors coupled with the fact that some of the information needed in planning an individual farm is often not available. Thus, for a time, it is more likely that the technique will be applied to farms which have been found by survey to be representative of many others. On the typical farm, the problems of the groups of farms which it represents may be studied in detail, and guidance obtained as to the main directions in which adjustments should be made. The Suffolk farm previously mentioned is typical, representing closely the organization of over 450 others. Here the main suggestions are:

1. Expand the acreage of cash crops, in particular by obtaining, if possible, a contract for threshing peas. Today, with a less favourable price for threshing peas, similar adjustments are suggested, except that most of the pea acreage is replaced by barley and the fodder for an extra cow.
2. Increase the size of the dairy herd.
3. In spite of this, reduce the acreage devoted to the dairy herd, by purchasing concentrates instead of growing oats and beans for feeding on the farm.

Naturally, other farmers may not be able to follow slavishly the suggested organization, but it does, at least, indicate adjustments that are worth considering and may well prove profitable on similar farms.

Such are the potentialities of linear programming on computors. In the end, of course, everything still depends, as it always has depended, on the farmer and nature in combination. But the technique offers a real advance in enabling the farmer to use his knowledge to better purpose.



Part of a computor tape showing plan for a farm near Cambridge.

The Lea Valley Today

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Horticultural Advisory Officers, Lea Valley Advisory Unit*

With its natural advantages and eighty-year-old tradition, the Lea Valley contains nearly a quarter of the total glasshouse acreage in Britain, and is likely to be the main centre of our glasshouse industry for many years to come.

ONE of the oldest, and certainly the largest, group of glasshouse nurseries in Britain is found in the Lea Valley, on the northern fringe of London. About five hundred separate holdings, totalling roughly nine hundred acres of glasshouses, are here assembled within an area measuring about ten miles by eight and occupying parts of Essex, Hertfordshire and Middlesex, with the urban district of Cheshunt at its approximate centre.

This unique concentration of holdings began some eighty years ago, when development in North London compelled nurserymen there to seek more rural sites. The Lea Valley offered ample supplies of water from shallow gravel or underlying chalk, and suitable soils for glasshouse crops; it was also convenient to London, with its expanding outlet for glasshouse produce, so that it was an obvious choice for these pioneer growers. At the same time came the introduction and speedy establishment of the tomato as a glasshouse crop, in addition to the cucumbers, grapes, flowers and ferns which were already popular. All the requirements for a rapid expansion of the industry were therefore fulfilled; its products were in great demand, external competition was limited, and the necessary resources for production were easily available.

Early history and progress

The earlier nurseries were established on the lower terraces of the valley at Turnford, Flamstead End and Turner's Hill, where the brickearth and flood plain soil series, classified as very fine sandy loams, extend to considerable depth. At first they were devoted to traditional crops—the first nursery built in the area grew maidenhair fern and grapes—but as they prospered, new and larger glasshouses were built specially for tomatoes. Some of the first of these houses, 170 feet long and 27 feet wide, were erected on the Rochford nurseries at Turnford in 1888. They produced two crops of tomatoes a year, the plants being grown in pots, and these same glasshouses are still in use, now planted with Muscat and Gros Colmar grapes. At this time the total annual production of tomatoes in the area was little more than 100 tons, compared with around 20,000 tons at present.

As the industry expanded, new nurseries were built in the Hoddesdon area

* "Lee" is the more correct spelling, but common usage since the sixteenth century declares in favour of "Lea Valley". *Editor.*

on the Taplow brickearth and gravel soils, and at Enfield Wash on the flood plain. By the turn of the century about three hundred acres of glasshouses had been constructed, and the pace of development was accelerating as the economic possibilities became apparent. Established nurseries grew quickly, and more enterprising employees began to establish their own holdings. Glasshouses were built on alluvial soils east of the river, at Waltham Abbey and Nazeing, in the years before and immediately after the first world war. In the final stages of expansion before 1939, development spread to parallel areas on the higher slopes of the Valley, where London and boulder clays predominate. The plentiful supply of stable manure still available from London at that time played a significant role in this development, making possible the rapid structural improvement of these heavier soils so that they could produce crops of economic yield.

At the height of its expansion, the area of glasshouses in the Valley totalled about 1,200 acres. The subsequent decline to its present level has occurred largely during the last twenty years, but even now it represents almost one-quarter of the total glasshouse acreage in Britain. There are no accurate records of the respective acreage of glass in each of the three counties within the area, but approximately 44 per cent of the present total is in Essex, 50 per cent in Herts, and 6 per cent in Middlesex. The major crops now grown are tomatoes (about 600 acres), cucumbers (about 300 acres), roses (about 100 acres), and carnations (about 60 acres). In addition, there are winter crops of lettuce, chrysanthemums and mushrooms, which follow tomatoes and cucumbers, and a total of some 30 acres is devoted to house plants, bedding plants, and other miscellaneous crops. The total capital value of the industry, excluding the land, is now estimated at over £10m, and the turnover at more than £6m a year.

As a collective noun used to describe holdings in this area, "the Lea Valley" is a phrase with great significance for those involved in this branch of horticulture. Indeed, it is a phrase which often possesses some emotional content, for the cultural practices and the business attitudes of growers here have been warmly criticized in recent years, and defended with equal vigour. Most often, criticism has been on the score of inefficiency and a failure to apply modern techniques. This is no doubt true of some cases, as it would be true of a proportion of any similar group of holdings, but it is notable that the contraction in recent years has involved the loss of many of the oldest and least productive holdings, and an allied modernization of those remaining. It is probably fair to say that the glasshouse industry in the Lea Valley now reflects the condition of the industry in the country as a whole. Apart from the fact that it consists almost entirely of heated glass, it produces much the same crops, and faces all the common difficulties which have arisen elsewhere since the last war.

Effects of labour shortage

One of the most important factors determining the Valley growers' policy in recent years, for example, has been the chronic shortage of skilled labour in the district. Wages for horticultural workers here are far above the minimum statutory levels, but even so, growers find it hard to compete for labour with those nearby light industries which can offer attractive working condi-

tions and recover their costs on production. The high cost of housing and the restrictions on building necessary in this Green Belt area also make it difficult to attract skilled workers from other parts of the country, and scarcity of labour alone has prevented many plans for nursery mechanization. This problem is common to most agricultural enterprises today, and the Lea Valley differs only in that here the problem is more acute.

Faced with this obstacle to intensification, some growers have contrived to spread their capital investment over an increased acreage of glasshouses, by purchasing established nurseries at prices much below the cost of erecting new ones. Investment of this sort, where running costs are kept at a minimum, can show a reasonable profit even though output may be lower than average; and although the standard of husbandry on these "ranched" nurseries may be criticized on purely technical grounds, it has some economic justification and some corollaries in other branches of agriculture. Other growers have turned to crops with a slightly lower labour and heating requirement, such as roses, in an attempt to meet the difficulty, and others again have planted crops such as carnations or chrysanthemums which can make profitable use of women workers. This policy is complicated by the need to maintain a large number of permanent staff to keep pace with necessary repairs and preparations during the off season, which in turn requires a high turnover per acre. The gradual swing from tomatoes to cucumbers which has taken place in recent years may have been accelerated by the higher gross return from cucumbers, associated with a constant labour force on the holding. Certainly the cropping changes of recent years, which are outlined in Table 1, have been inspired, to some extent, by labour difficulties as well as by national economic circumstances.

Table 1

Acreage of main glasshouse crops

	Tomatoes		Cucumbers		Roses		Carnations	
	1950	1958	1950	1958	1950	1958	1950	1958
	acres							
Essex	449	360¼	103	131¼	6	12¼	9¼	15
Herts	440¼	204¼	102	131¼	53	94¼	11¼	22¼
Middlesex	145¼	63¼	19¼	16¼	¾	1¼	26¼	31
Total	1,035	628¼	224¼	279¼	59¼	108¼	47¼	68¼

From the July Glasshouse Returns 1950 and 1958. In 1950, holdings with less than 1,000 sq. feet of glass were not included. The census for July 1958 was limited to occupiers of holdings with more than one acre of land used for agriculture and with not less than 1,000 sq. feet of glass (excluding lights and cloches).

Modernization programmes

Despite labour difficulties, however, many growers in the Lea Valley have carried out modernization programmes of some scope, and in particular a great deal of attention has been given to improving heating systems. The trend towards earlier planting, especially of tomatoes, which has been stimulated by foreign competition since 1945, has made nurserymen very conscious of the need for efficient heating. The critical influence of temperature control on crop yield and quality, which has been amply demonstrated by research workers since the war, is widely appreciated.

Until recent years the traditional system of tubular boilers and four-inch hot-water pipes with gravity circulation was common to most nurseries. Anthracite was the usual fuel, and most boilers were hand-fired and only large enough to heat half an acre of glasshouses. On large nurseries this system involved a multiplicity of small boiler-houses, requiring constant supervision, together with the labour of distributing fuel from a central stack, a famous example of which consisted of over five thousand tons of anthracite. Close temperature control in glasshouses, where such a system is installed, depends largely on skilled stokers, and even so it can never be entirely satisfactory. On many nurseries today a central boiler plant, burning oil or low-grade solid fuel, has replaced the smaller units, with a consequent gain in efficiency and reduction in heating costs. The few large units with direct heating by low-pressure steam were installed about ten years ago, and this method is only rarely considered now.

A small number of growers have taken to low-pressure steam injection into water, and transitional work on improving heating systems is a fairly common sight in the Valley. Where the traditional boilers have been retained, heating systems have been improved by the use of pump-assisted circulation with temperature controls, and increased piping in the houses. Four-inch piping is still generally used, and owing to the cost very few growers contemplate introducing systems involving small diameter pipes with high speed hot water, which have been widely recommended. So long as older nurseries are being dismantled, and secondhand four-inch cast-iron piping (which is virtually everlasting) is available at less than half the cost per foot of new two-inch piping, this policy is likely to continue.

Table 2

Glasshouse holdings in England and Wales

	No. of holdings				
	20,000–30,000 sq. feet	30,000–40,000 sq. feet	More than 40,000 sq. feet	over 200,000 sq. feet	Total No.
	per cent				
Essex, Herts, Middlesex	14·6	15·3	70·1	50	465
East Sussex, West Sussex, Lancashire	39	20·8	40·2	10	336
Rest of England and Wales	36·4	18·8	44·8	41	905

From the July Glasshouse Returns 1938

Although evident progress has been made in the modernization of heating systems, however, it has not been as quick or complete as might have been expected. Labour difficulties which have already been discussed offer one explanation of this apparent inertia on the part of growers in the area. Another important factor, not often appreciated, is the scale of operations on many of the nurseries. Table 2 shows clearly how much greater in size is the

average Lea Valley nursery compared with those in the rest of the country. For example, in Essex, Herts and Middlesex there are 465 holdings with over half an acre of glass. Of these, 70 per cent have more than one acre of glass, compared with 40 per cent of similar groups of holdings in other parts of the country. About half the number of nurseries with over about five acres of glass are found in this area, and there are few with over ten acres outside it. Remodelling a heating system and installing central boiler plant is a project which by its very nature cannot properly be undertaken piecemeal and, where five or ten acres of glasshouses are involved, the cost will run into many thousands of pounds. In the present transitional stages of the industry, a very bold management is needed to sanction wholesale expenditure of this order.

The problems of management on large nurseries are not restricted to major decisions, such as those relating to heating systems. On small intensive nurseries, high yields are achieved by constant minor decisions about cultural techniques, made promptly by an owner or manager who is intimately acquainted with his crops. On extensive holdings, responsibility for such decisions must be delegated, and in the process they lose some of their urgency and perceptiveness. A lack of fine control over cultural operations certainly depresses yields, and one of the problems of the larger enterprise is to create a management structure which limits this effect. Unlike other industries, horticulture does not easily allow the replacement of manual skills and individual judgment by mechanical techniques, and with the growing size of enterprises and the scarcity of responsible labour, management methods are likely to need increasing study in the near future.

Packing and marketing

Among other major developments in the Lea Valley of recent years are those relating to the packing and marketing of produce. The bulk of the Lea Valley produce is sent to wholesale markets throughout the country, and only a few smaller growers have retail outlets for their crops, so that a large fraction of the English glasshouse produce available in major markets is contributed from the area. Such an important share of the market is a great responsibility at a time when standards of produce packaging and quality are under criticism, and larger growers particularly are aware of this. Over the last few years there has been steady progress in the improvement of packing techniques, and non-returnable containers are now used without exception for tomatoes, and very widely for cucumbers, carnations, roses and chrysanthemums. At least one enterprise is pre-packing tomatoes on a considerable scale, and many others have so reorganized packing-shed layout as to have extremely efficient control of grade qualities—not an easy task when several tons of produce are handled daily.

A co-operative marketing scheme has been successfully established so that relatively small quantities of produce may be efficiently handled and sold in bulk. In the last eight years, this organization has shown an increase in turnover of £262,000 for marketing produce, and of £70,000 in sales of sundries to members. In combination, such projects have considerably improved presentation standards, but the more difficult problem—that of improving overall quality by cultural means—is not so easy. In the case of tomatoes

especially, better grading is only one step, perhaps a very small step, towards a good quality pack, and the production of high-quality fruit of even grade is far more important. Unfortunately, those difficulties which bedevil older nurseries—inadequate heating, unbalanced soils, and poor light transmission in old glasshouses, among others—are just those which depress fruit quality, and it requires a nice combination of cultural skill and capital investment to overcome them.

During the last few years, there have been many other technical innovations relating to the major glasshouse crops besides those already discussed, and in the Lea Valley, as elsewhere, they have greatly influenced crop management and yield. It is beyond the scope of this survey to discuss them in detail, but many of them are worth mention as illustrating the type of change which is taking place. For example, there is much interest at present in glasshouse soil management and improvement. The various soil analysis services available to growers are in great demand, and one or two of the larger nurseries now carry out this task themselves. As a result of this increasing interest, much greater emphasis is now placed upon soil structure improvement, drainage, and the control of salt levels by careful fertilizer application and winter flooding. With glasshouse crops, problems of nutrition and root development are inseparable from those of watering, and on many nurseries automatic watering systems are in operation, with tensiometers or photometers to measure water requirement.

Control of pests and diseases

Changes in pest and disease control have been frequent in recent years, and although serious losses of crops still arise from pests such as red spider mite, they are much reduced in comparison with former years. The concentration of glasshouse crops in the area is such that pathogens will naturally flourish, but there is some compensation for this in the availability of contract spraying services and soil sterilization equipment on hire. Also by virtue of its concentration, the industry receives very efficient technical service from commercial suppliers of insecticides, fungicides and fertilizers, and new materials for these purposes are quickly adopted.

There is of course a certain amount of conservatism and opposition to change, which is perhaps inherent in all industries that are long established and have a prosperous record, and which it would be easy to criticize and exaggerate. Sudden, sweeping changes in a system of production which has proved satisfactory are not to be expected, and growers may be excused for caution towards them. The past holds many examples of much-publicized innovations which in the event have proved uneconomic; a certain amount of scepticism is justifiable. Nevertheless, changes are being made in cultural treatments, choice of crop varieties, capital equipment and management technique, and the pace of this progress has been accelerated by increasing economic pressures.

There is no doubt that the new Lee* Valley Experimental Horticulture Station will greatly stimulate interest in new crops and cultural techniques. The station, one link in the chain of several throughout the country,† was

* The spelling "Lee" has been officially adopted for the Station.

† Introduction, *Experimental Horticulture*, No. 1, 1957, iv-vii. C. E. Hudson.

established at Hoddesdon in 1958 to serve growers in the eastern counties. Approximately two-thirds of an acre of glasshouses has now been erected, and an extensive programme of experimental work begun on the main crops in the Valley. As development proceeds by stages, other glasshouse crops will receive due attention. The function of the station is to experiment and not to demonstrate, but here the grower will be able to see and discuss at first hand combinations of cultural techniques which produce maximum yield.

In all, it would seem that the Valley will remain the major centre of our glasshouse industry for many years to come. No doubt the acreage of glass here will decline still further, although not perhaps so quickly as in recent years, but those nurseries which remain will be the most efficient and most modern ones. The area has many deficiencies for the glasshouse grower, particularly because of poor winter light conditions and atmospheric pollution, but it also has many advantages. There are still the water supplies and suitable soils which attracted early pioneers. Added to these are an excellent train service to the midland and northern markets, and a host of central services for marketing, technical advice, and contract work, which could not be obtained so easily elsewhere. The Lea Valley Growers' Association, the local branch of the National Farmers' Union, is a powerful negotiating body which firmly represents the interests of the growers in the area. And perhaps most important of all, the industry here now has a long tradition which will be a strength to it for many years to come.

Our thanks are due to Mr. J. P. Rochford, V.M.H., J.P., Nursery Trades (Lea Valley) Ltd. and Lea Valley Growers' Association Ltd., who supplied information for inclusion in this article.

Intensive Grazing of Sheep

G. R. DICKSON, PH.D.

Fitzalan-Howard Estates Ltd., Worthing, Sussex

Lambs have made exceptionally good progress in a trial of rotational creep grazing on a commercial scale at the Nafferton Farm of Durham University. Ninety-eight lambs sold before weaning averaged 42 lb estimated dressed carcass weight.

IN dairy farming, new grazing practices appropriate to highly productive swards have met with outstanding success. Unfortunately, however, there has been a tendency to assume that such practices are equally applicable to sheep, without giving consideration to the different nutritive requirements of ewes and lambs, and the added complication of worm infestation. As sward productivity and sheep concentrations increase, two basic problems arise. Firstly, the heavier contamination of the sward with dung and urine hinders the provision of a constant supply of palatable and highly-nutritious herbage to the sheep. Secondly, the risks of worm infestation and other diseases are generally greater at higher stocking levels. These problems must be solved, if sheep farming is to derive full benefit from recent advances in grassland production.

Rotational grazing of sheep has met with very limited success, confined to greater gain per acre. This indicates the efficiency of the system as a means of pasture management, but the inferior quality of rotationally-grazed sheep suggests inadequate conditions for animal growth and development. These inadequacies stem from the incompatability of ideal sward and stock management within the system.

Complete defoliation of the sward at each grazing is essential for uniform pasture recovery. The condition of the animals, however, must be sacrificed to attain this, as it requires the consumption of the unpalatable and less nutritious herbage. The diet of the lamb is thus undermined by the decline in the quality of the available herbage as defoliation progresses. Because the young animal is so selective in grazing, it may half starve itself rather than eat unpalatable herbage; therefore its diet also varies in quantity as the sward becomes less palatable. The extent of these variations is further increased in rotational grazing by the competition of the ewes for available grass.

The alternation of grazing periods and pasture rests is likely to interrupt the constant cycle of reinfestation, and expose the free-living stages of the parasite to adverse environmental factors for a longer time. These controlling effects may, however, be eliminated by the contamination of the sward at higher stocking levels. Larval uptake may also be increased by close grazing, as most of the infective material tends to be concentrated in the lower regions of the sward.

Advantages of rotational creep grazing

A research project was started at Cockle Park to improve the facilities for lamb production within the rotational system, without impairing the conditions for herbage growth. Creep grazing was incorporated, giving the lambs access to the pasture ahead of the ewes. This enables them to maintain a constant, highly nutritious diet on young leafy swards without competition from the ewes. The separation of ewe and lamb grazing also facilitates the use of the lower nutritive requirement of the adult sheep, particularly in the later stages of lactation, to complete sward defoliation.

The extent to which economy can be made in the diet of the ewe was indicated in a recent study at Cockle Park. Lamb growth was found to be closely correlated to milk yield during the first eight weeks of life, but thereafter no relationship is evident. This suggests that at about the eight weeks stage, good grass becomes more important than milk in the lamb's diet. It is advantageous, therefore, to reduce the nutritive level of the ewes to ensure complete pasture defoliation, so that a steady sequence of young, leafy herbage is maintained for the lambs.

The nutritional advantages of creep grazing strengthen the resistance of the lamb to worm infestation. Further benefit is derived from the reduction in the uptake of infective material, by the avoidance of the heavily-infected lower regions of the sward. In completing defoliation the resistant ewes ingest and destroy the bulk of this infection.

In addition to the improved facilities for the lambs, rotational creep grazing allows more efficient use to be made of the ewes during the suckling period. In the early stages of lactation, when milk is of prime importance to the lamb, the effect of creep grazing on the pasture is negligible and the ewes

have ample herbage for milk production. Later, grass becomes the dominant factor in the lamb's diet, and the quality and quantity of pasture available to the ewes is automatically reduced by the increasing intensity of creep grazing. This adjustment continues until just before weaning, when the presence of the ewes is justified only by their role in pasture defoliation and disinfection. This natural adjustment avoids any marked weaning check in the lambs, and overcomes the problem of wasteful fattening of the ewes before weaning.

The results summarized in the table were recorded in a comparison of rotational creep grazing with the normal rotational practice at Cockle Park.

Mean liveweight gain, condition and maximum faecal worm egg counts of lambs

	1955 13-week period 29th April–25th July		1956 14-week period 4th April–9th July	
	Rotational grazing	Rotational creep grazing	Rotational grazing	Rotational creep grazing
Mean liveweight gain (*lb*)	50	54	42	53
No. of fat lambs at weaning	38	47	4	38
No. of store lambs at weaning	26	17	76	42
Maximum mean faecal worm egg counts				
All species (eggs per g faeces)	1,182	788	3,243	1,669
Nematodirus species only (eggs per g faeces)	830	602	1,760	822

Creep grazing gave an additional liveweight gain of 11 lb per lamb, and a 50 per cent reduction in worm burdens, during a fourteen-week suckling period in 1956. The value of the liveweight increment was enhanced by the better condition of the creep-grazed lambs, 50 per cent of which were fat at weaning compared with only five per cent of the normal rotationally-grazed group.

Trial on commercial scale

As a sequel to this research, the system was applied in 1958 on a commercial scale on Nafferton Farm of King's College, University of Durham. A 24-acre ley was subdivided into six 4-acre paddocks, with netting and plain wire fences in which creeps were installed at 50-yard intervals. The lamb creeps consist of eight or nine stakes driven into the ground nine inches apart and secured at the top to a horizontal rail. When not in use the creeps are closed with a wire netting flap. The total cost of the fencing amounted to about £80, of which only a part is attributed to that year. Fertilizer treatment of the pasture consisted of an initial early spring dressing of 3 cwt NPK (12:12:18) per acre, and two subsequent applications of 2 cwt "Nitro-Chalk" per acre.

The sheep were introduced to the unit on 31st March, at stocking levels of approximately eight ewes and eleven lambs to the acre. Supplementary concentrates were fed separately to the ewes and lambs during the first two weeks, and were partly responsible for the immediate commencement of creep grazing. No mis-mothering or undue disturbance was experienced, and

no worm drenches, or any form of veterinary treatment, were given to the sheep.

The grazing unit was such that the ewes were able to defoliate the paddock completely in 3–4 days, so giving pasture rests of 2–2½ weeks. This interval was sufficient for adequate recovery, without allowing the sward to pass the ideal stage of 3–4 inches. The increasing rate of pasture growth as the season progressed was compensated by the increasing herbage intake of the lambs, so there was no recourse to mechanical topping.

Exceptional progress of lambs

The progress of the lambs was so exceptional that fifty were sold fat in May. Half of these were only ten weeks old, and were graded at 40 lb estimated dressed carcass weight. During the 13-week period from 31st March to weaning on 30th June, a total lamb gain of 5½ cwt per acre was obtained. Ninety-eight lambs sold before weaning averaged 42 lb estimated dressed carcass weight, and realized £7 7*s*. 6*d*. a head plus the guarantee payment. The remainder were in good forward store or near fat condition. The state of the ewes at weaning was satisfactory, and afforded ample scope for flushing in the autumn.

These results substantiate the promise of the experimental findings at Cockle Park by giving an exceptionally high output per acre without sacrificing the quality of the individual lamb. The intensity of production is such that the system may provide an economic alternative to dairying, particularly on small and medium-sized farms. In addition to the many advantages of the system in flock management, its application may be of considerable benefit to a farm as a whole. The successful concentration of sheep in this way releases a greater acreage for other farm enterprises, without impairing the profitability of the ewe flock.

I am indebted to Professor M. McG. Cooper and Mr. A. Main of the University School of Agriculture, Kings College, Newcastle-upon-Tyne, for their advice and assistance throughout these trials.

★ NEXT MONTH ★

Some articles of outstanding interest

NUTRITION AND POULTRY DISEASES *by L. G. Chubb*

SEED POTATOES FROM YOUR OWN FARM *by P. H. Brown and L. Broadbent*

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Slatted Floors for Livestock

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Experiments with slatted floors are going on in this country with the object of reducing the annual bill for straw and the labour for handling it. Several seasons' experience must be gained before definite conclusions can be reached, but first impressions are promising.

ONE of the major problems facing many stock farmers is the cost of supplying and handling litter. The reduction in the arable acreage, the popularity of short-strawed varieties of cereals, use of the combine harvester and the high cost of transport are likely to aggravate the position and make straw even scarcer than at present. Slatted floors are one possible solution to this problem. They will not, of course, fit into the economy of every farm, and it must be realized that at present their use in this country must be regarded as experimental. In Norway and elsewhere, slatted floors have been in use for some years; sheep have been kept on slats in Iceland for centuries, and more recently quite large herds of cattle have been kept on them during the winter months.

The Norwegians place great emphasis on cow comfort; the cellar under the slats must be sealed, so that there is no draught or loss of heat. Each animal must be allowed the right amount of floor space—20 sq. feet or whatever is decided—according to its size; if it is allowed more space the system breaks down. The slats are not cleaned, but a little sawdust is put down each day to keep them dry; the manure accumulates in a large cellar, up to 10 feet deep, underneath the floor. Cattle, pigs, sheep and poultry are kept under these conditions: it is an advantage if the animals start on slats as youngsters.

Although timber is plentiful in Norway it is softwood, so for cows and pigs concrete is preferred. For calves, sheep and poultry, wooden slats are excellent.

On the whole the Norwegians favour a wider slat than we do, but recently they have tended to accept a narrower slat than previously. At the 1959 Royal Agricultural Show of Norway, held in Oslo, buildings stocked with animals on slats were the main theme of the farm building section. It is of interest that the Royal Agricultural Society plans to stage a similar exhibition at the 1960 Agricultural Show, to be held at Cambridge.

Slats for calves and beef cattle

Various pioneers, to whom great credit is due, have tried slatted floors for stock in this country, with varying success. Space forbids a description here of the use of slats for pigs, poultry and sheep: the problems may be slightly different from those described here, which are based on experience with calves and beef on slats. For dairy cows we must at present rely on observations on their use in other countries. Experience will be gained with cows on

slats here this winter, and it will be possible to give a first-hand opinion by next spring. Investigations on the Silcock farms are experimental, with the object of reducing the annual bill for straw and labour for handling it. Obviously, experience must be gained over several seasons before definite conclusions can be reached.

Slats for cattle can be of wood, concrete or possibly other materials. Wood is cheaper than concrete, and not so heavy; it is easier to handle with farm labour and can be used for other purposes after it has been used for floors. Hardwood is said to be better than softwood, and elm may be preferable to oak, as it wears rough, is not slippery, and does not rot under damp conditions. The wood must be sound, and not from the outside of the trunk or it will wear quickly. It must be free from faults or possible weakness in the length, or it may crack.

Concrete is more durable than wood, it appears to keep drier, and seems to be just as acceptable to the cattle. It must be made by skilled craftsmen, however, as it will be rough and may shatter if not cast properly.

The dimensions of concrete slats will obviously depend on the method of reinforcing. Wooden slats, 3 inches by 5, are being used for cows on several farms locally. Using elm boards we have been working with 12-feet slats, 8 inches wide on top tapering to 7 inches wide underneath and 3 inches thick, supported every 6 feet, with a 2-inch gap between the tops of them. This has proved very satisfactory for cattle from about 4 months old, but for mature cattle it might be wise to support every 4 feet. The slats are in sections of three, tied together with 4 × 2-inch softwood, so that they can easily be moved for cleaning out. For calves up to 6 months, 6–12 sq. feet of floor space is desirable; for yearlings to 18 months, 20 sq. feet; for stores/fattening cattle, 18–24 months, 25 sq. feet; for mature beef cattle, 2–3 years, 30 sq. feet, and for cows 35–45 sq. feet. The more cattle there are in a group, the smaller is the area required per beast.

For calves it is found that tapered slats of 2–3 inches across the top, 1½ inches apart, are satisfactory; narrower slats may tend to warp, leaving a dangerously wide gap, though if calves are reared on the slats they seem well able to avoid this hazard. For cows, 5 × 5-inch or 8 × 3-inch slats, with a 2-inch gap, will be used.

At 20 sq. feet per beast, the animals make about one foot of muck, in depth, per month.

If any long material, such as hay or straw, is fed on the slats, or can be carried on to them on the animals' feet, some will go through, and it will be necessary to clean out the manure with a fore-loader. On the other hand, hay or straw, plus the sawdust sprinkled on the slats, dries up the manure and urine, heat is generated to a temperature of 80°F, and the whole is easy to pick up with the tines of a fore-loader and spread by an ordinary muck-spreader. If no long material gets through the slats, the sludge underneath can be removed by a liquid manure spreader provided it is not allowed to dry up. If it is to run, the fall of the floor should not be more than 1 in 50. Some farmers think a level floor is most satisfactory.

Costs and condition of the cattle

At the end of the equivalent of two winters' work with young stock and

beef cattle, we can say that the cost of the installation has been saved by reduced expenditure on litter. The saving of labour, in both cost and effort, has been surprising and very acceptable. The cattle and the slats have kept clean —very clean in fact. The feet are good and, if anything, the cattle have done better than they did on straw, probably because they are quieter and cannot pick up parasitic infections. The stocking capacity of buildings has been increased considerably, reducing building costs per head.

No major snags have developed, but the initial cost can be considerable. Dairy heifers on slats which are too wide might get a little sickle legged if kept on too long, but up to six months there is no obvious damage of this sort. Cows kept on slats and self-fed may have to be trained to sleep on the slats.

The experiments will continue. Purely as a commercial investment the area of slats for beef cattle and young stock is being extended considerably, and floors are being put down for cows as there is so much interest in the subject. Such floors, being still experimental, are not grant aided under the Farm Improvement Schemes. The cost of the floors varies from £5 to £13 a year. In due course the results of the experiments will be reported and, unless there is good reason to go ahead with a new installation, farmers contemplating this development for cows may be wise to await the outcome of these. The Royal Show will provide a forum where the keeping of all stock on slats can be discussed quite freely. The arguments are likely to be fierce and long, but that is the object of the exercise.

Tulip Eelworm

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All tulips are susceptible to eelworm attack. Hot-water treatment remains the most reliable form of control, and pre-treatment storage at the proper temperatures may lead to its successful and more widespread use on commercial tulip bulbs.

THE tulip race of the stem and bulb eelworm *Ditylenchus dipsaci*, better known among bulb-growers simply as tulip eelworm, is nowadays a major pest wherever tulips are widely grown. It was first recorded in the Netherlands in 1906, and again in Ireland in 1912. There have been further reports of its presence in the Netherlands in recent years. Its increase in this country from a curiosity to a menace has been almost spectacular: although reports of it were current around 1940, it was not until 1943 that it was first officially recorded.[1] By 1953, infestation had assumed alarming proportions.[2] Growers

who a few years earlier had ridiculed the possibility of such a pest were having to take an interest, and a few small growers who had over-cropped with bulbs were forced out of business. Most of the trouble appeared to be in the Holland division of Lincolnshire, but no doubt this was because about two-thirds of the country's tulips are grown there.

To provide accurate information on the incidence of eelworm in the Holland division, the Ministry of Agriculture surveyed tulip stocks there in April and May 1955.[3] This statistically-designed survey, based on presence or absence of the pest, was conducted on 134 growers' holdings with an estimated acreage of 418¼; that is to say, on 25 per cent of the tulip acreage farmed by 21 per cent of the growers. The results showed that 11·5 per cent of the stocks inspected were infested with tulip eelworm. Two years later it was estimated that this figure had doubled; but it must be emphasized that these figures represent stocks and not acreage. It is not unusual for one grower to have two or three stocks of one variety.

What reasons can be advanced for such an increase? There is little doubt that the high prices of bulbs immediately after the second world war had a big influence. During the war, stocks of bulbs were deliberately run down to make way for food production. After 1945, every effort was made to increase stocks as rapidly as possible, and some which in normal times would have been destroyed, were propagated. Prices were such that even half a crop paid. As the stocks of bulbs became larger, they were planted more closely in the rotation, especially on the smaller holdings, and this encouraged eelworm spread. Again one must emphasize that this was a new pest which growers were unable to recognize, particularly in its early stages; consequently no efforts were made by growers to control it. Lastly there is the very natural reluctance of any bulb-grower to destroy his stocks (then the only method of control) even when prices are normal, since in many cases bulb stocks represent a grower's capital. These reasons, and the fact that there is always a large interchange of stocks in the bulb-growing areas, were the prime causes of the rapid increase.

Symptoms best seen at flowering-time

Tulip eelworm is a minute, thread-like worm about one-twenty-fifth of an inch long, which lives inside the bulb scales and absorbs the contents of the plant cells. Symptoms are best seen at flowering time and, in fact, this is the only reliable time to look for them. Affected blooms are usually distorted, with the head cocked over to one side. In the bend so formed small cracks and splits appear, running up and down the stem. The colour of the flower will often be seen in this area, and the green of the stem is often carried into the flower, giving in some cases a completely green petal. Stems of infested plants may be distorted or abnormally thickened at the nodes, and in extreme cases the whole plant will be distorted and dwarfed. Readers are referred to the publicity leaflet *Can* you *Recognize Tulip Eelworm?* issued by the Ministry of Agriculture in March 1959, which gives a short series of coloured pictures showing symptoms. Eelworm infestation shows up particularly well during forcing, and in the glasshouse the leaves of the plant may show ragged holes—a symptom rarely seen outdoors.

Cracks running across the stem are not caused by eelworm. These are

quite common and usually follow a period of rapid growth. It is, however, possible to confuse one type of weather damage with eelworm symptoms: these are so much alike, particularly in the variety Orange Wonder, that a microscopical examination is necessary to be sure.

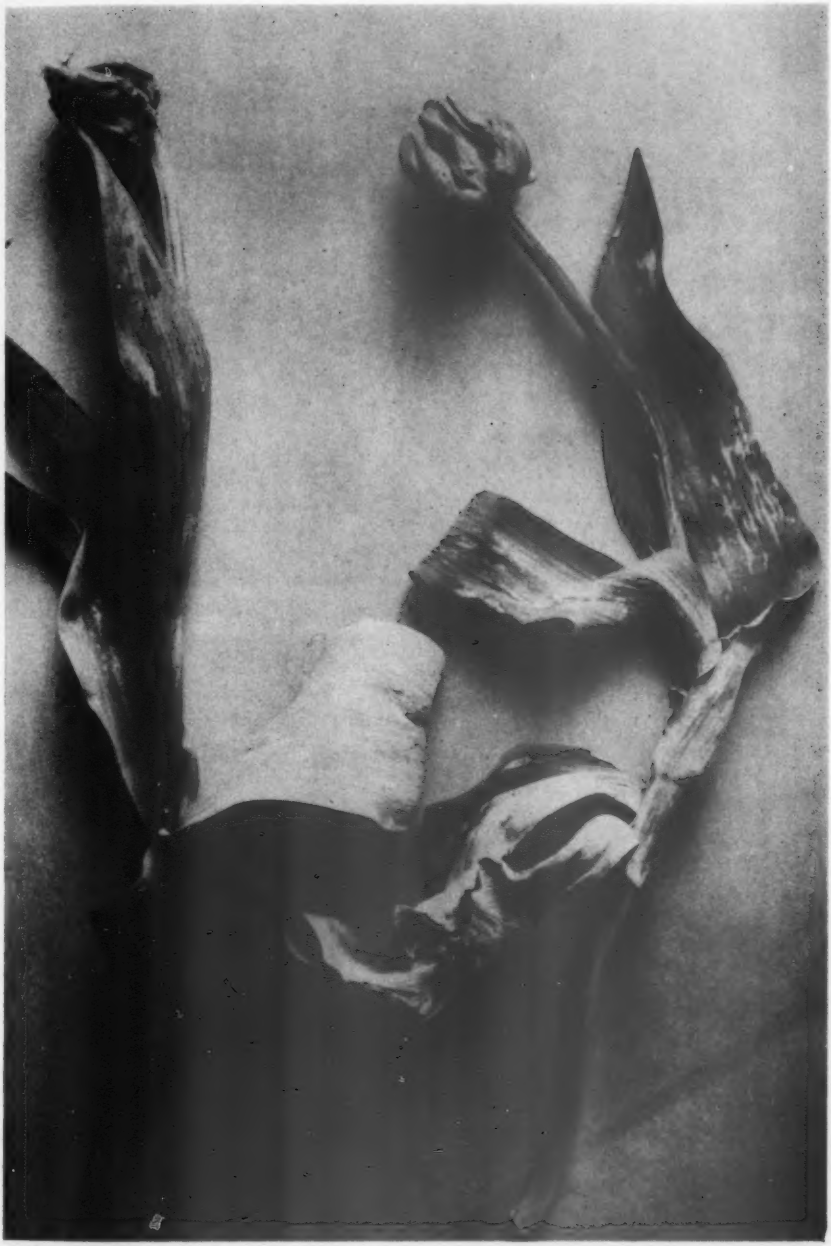
The symptoms in the dry bulb are not nearly so well defined, and it needs considerable practice to distinguish an eelworm infestation from other troubles at this stage. The attack usually, but not always, starts from the base of the bulb, and a silvery-grey patch develops on one side just above the base plate. This extends and turns to a silvery-brown as the attack progresses until the bulb becomes soft, papery and light in weight, forming what is often known as a "cork". Only rarely does a cross-section of the bulb show the brown "ringing" so characteristic of eelworm in narcissus: this symptom cannot, therefore, be used for diagnosis. In fact the dry bulb stage alone should not be used for diagnosis, since eelworm is recognized so much more readily and accurately in the field. The fact that a tulip bulb can carry an appreciable amount of eelworm without showing symptoms is a further reason for examining it during the growing season, and certainly precludes any hope of cleaning up a stock by sorting bulbs.

All varieties are susceptible to attack by eelworm. There is an apparent difference in the severity of attack from variety to variety, but it is by no means certain that this is because of varietal susceptibility. For example, many stocks of the varieties Mozart, Rijnland and Fantasy are infested, but this could well be because they are older and popular varieties, and were among the first to suffer. As the stocks have greatly increased, so the eelworm has been more widely distributed. On the other hand, eelworm is rarely seen in the newer Darwin hybrids. Nevertheless there is every reason to believe that it will show up in them as soon as they have been in close contact with infested stocks. Having become infested with eelworm, all varieties except one—Argo—will show the field symptoms readily. Argo can apparently be heavily infested yet show only slight symptoms.

Many host plants

The complete range of plants which may be infested by tulip eelworm is as yet unknown, but is probably considerable. J. F. Southey,[4] growing plants and bulbs in inoculated pots, confirmed that in addition to tulips, hyacinth (*Hyacinthus orientalis*), daffodil (*Narcissus* hybrids), *Scilla siberica*, bluebell (*Endymion non-scriptus*) and phlox (*Phlox paniculata*) could all become heavily infested. Strawberry (*Fragaria* × *ananassa*) was noted as becoming lightly infested, while snowdrop (*Galanthus nivalis*), Dutch iris (*Iris* hybrids) and onion (*Allium cepa*) were considered to be doubtful hosts. In grape hyacinth (*Muscari* spp.), oats (*Avena sativa*), and red clover (*Trifolium pratense*) the eelworm did not develop, and these were classed as non-hosts.

Tulip eelworm has also been found in a number of common weeds growing on infested tulip fields; some of these may maintain infestations in the absence of tulips. It is interesting to note that although daffodils are an excellent host for tulip eelworm, which can cause at least as much damage as the true narcissus race, tulips are not a host for the narcissus eelworm. Unfortunately, in practice one rarely knows whether narcissi are infested by the tulip or narcissus race, and consequently it is not advisable to follow



Tulip eelworm causes cracking of the stem, particularly under the flower-bud, distortion of the flowers, and cracking of the leaves. The latter is usually visible only in forced plants.

Some of the original glasshouses in the Valley, built in 1882. A block of four houses, 60×12 feet.

Modern aluminium-framed glasshouses.

(Article on pp. 440–6)

Grading and packing tomatoes from about 30 acres of glass.

A centralized heating unit for 4½ acres of glasshouses.

Slatted Floors for Livestock (Article on pp. 450–2)

Photo: *Gayroma*

Beef Shorthorn and Aberdeen-Angus × Ayrshire cattle lying comfortably on slatted floors.

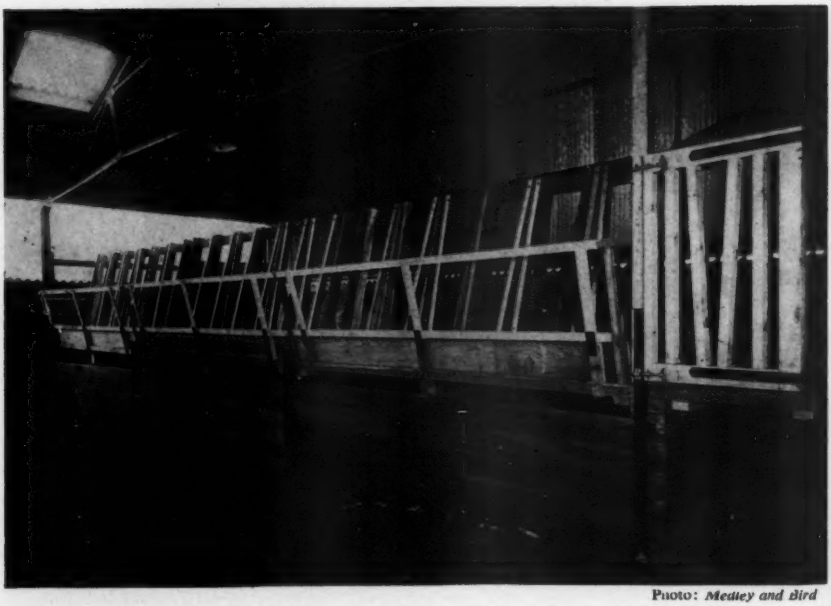


Photo: *Medley and Bird*

The boarding along the front of this slatted floor is most important to keep out draughts. The top board has been taken away to show the supporting 9-inch walls, every 12 feet, and the 8 × 6-inch beam in the middle, which can be removed for cleaning out.

daffodils with tulips, or vice versa, in the rotation, although this is still a fairly common commercial practice. Without doubt, one of the most important ways in which eelworm is carried over from year to year is on the self-set or volunteer bulbs, which means that the rotation must be considerably lengthened. It is not uncommon to find such bulbs five years after the crop has been lifted, in spite of intervening arable cropping.

The spread of eelworm from bulb to bulb or stock to stock in the field can be swift, and the presence of only one slightly infested stock renders all the others suspect. This can happen in a number of ways. For example, contaminated soil can be carried on boots and implements, and on the feet of birds and vermin, especially in wet weather, when the soil picks up easily. Increase in the individual bulb following slight contamination is then rapid. Temporary surface waterlogging, such as occurs after snow or very heavy rain, can also cause much spread. Further, there is a pre-adult stage in the life-cycle of the tulip eelworm which is highly resistant to unfavourable conditions. This stage is readily found dried up and dormant in dead pieces of infested stem, leaf and flower. Such debris, carried on farm implements, in flower-boxes, or blown about by the wind, can also carry the eelworm to clean stocks.

Ways of preventing infestation

It follows from this that the most practical measure to prevent infestation is the practice of strict hygiene at all times. Cresylic acid at the rate of 1 gallon, plus 1 gallon of a wetting agent, to 200 gallons of water is a useful disinfectant to have on hand for washing down implements and tools, and for dipping bulb-trays. All bulb cleanings should be burned or buried deeply. If they are buried, pits should be dug on grassland and well away from possible future bulb-fields.

Cultivations after planting should always be in the same direction as the rows, never across the beds. It is advisable to plant stocks in the field in the same order each year, preferably in the order of lifting; then if eelworm is found in any stock the spread is normally limited to those next to it. New stocks, even of the same variety, should be numbered and kept separate from others for at least two years' growth, so that their freedom from eelworm can be established. Great care is needed when buying in new stocks: it is obvious they should be bought from a reputable grower, but in addition the prospective purchaser should make his own inspection at flowering-time. It is surprising that this inspection, quite common among other flower crops, has not been carried on in the past to any extent among bulbs.

Treatment of infested stocks has, of course, occupied the minds of growers and research workers ever since the pest first appeared. In view of the success of hot-water treatment in controlling eelworm in narcissus, it was obvious that it should be tried for tulips. The early experiments were virtually a failure, based as they were on the techniques used for narcissus. Other cultural methods were therefore used, and still have a place today. Forcing off the larger sizes of suitable varieties, whilst destroying the smaller sizes, is one way of disposing of infested stocks which does not mean a total loss of income. Infested fields can also be rogued, but this is practicable only where very slightly infested stocks are involved. The spread of tulip eelworm under

normal conditions in any one year, makes it necessary to remove all bulbs within a radius of three feet of the infested area. Therefore even a few slight infestations mean the removal of a large quantity of bulbs. Great care is needed, when these infested specimens are being carried off the field, to prevent contamination of healthy plants by dropped soil and debris. Paper sacks are most useful for this work. Attempts have also been made to check the spread of infested stocks by frequent official inspections at auction sales and bulb warehouses, but eelworm was already too widely distributed for them to be really effective.

Hot-water treatment

These methods all relate to preventing the spread of eelworm, but what was really needed was a cure, and the most likely method of control remained the hot-water treatment. With this object in view, a series of experiments was undertaken at the Kirton and Rosewarne experimental stations. First results indicated that the timing of the operation was all-important. Horton[5] described how an examination of the internal stage of development of the flower-bud showed that as each stage was completed, subsequent hot-water treatment killed all the parts which had developed. Further, if the treatment was done after internal root development had commenced, the roots were also killed, and the bulbs produced no growth at all.

The bulbs in the experiments were immersed in water at 110°F, for periods of two and three hours. There was appreciably less damage from the two-hours treatment, but there was doubt whether two hours at 110°F would kill all the eelworm in the bulb. The first tentative recommendations were, therefore, to lift early (at the end of June or early July), and to apply hot-water treatment at 110°F for 2½ hours before mid-July. This treatment was put into limited commercial practice in 1954–55, with variable results. Generally there was appreciable damage to the flower in the first year after treatment, and often damage to the foliage. But there also appeared to be a very satisfactory stock revival, even where the flower had been killed and the foliage damaged, and by the second year after treatment a good clean stock was obtained. By 1957–58 the technique had become more widely known and was better applied. The calendar dates had been replaced by observations of the growing crop, and the bulbs were lifted as soon as the leaves had ceased to function. Shed storage at air temperature for 7–10 days was given before treatment. There was, however, still an appreciable risk of treatment injury.

It also became obvious that there was an immense difference in the susceptibility of varieties to damage by hot-water treatment. This factor was investigated at Rosewarne[6, 7] and to a lesser extent at Kirton. Many observations were also made among commercially-treated stocks in Lincolnshire. As a result of these observations the following list, still incomplete, has been compiled:

1. Varieties whose survival is poor and which are rarely an economic proposition to treat:

   Dillenburg, Rijnland.

2. Varieties where damage to the foliage and flower is likely to be considerable, but where a reasonable stock survival can be expected:

Afterglow, Algiba, Aristocrat, Bandoeng, Baronne de la Tonnaye, Beppy, Clara Butt, Cramoisi Brillant, Edith Eddy, Fantasy, Golden Harvest, Greuze, Jeanne Desor, Krelage's Triumph, Mother's Day, Mozart, Mrs. E. H. Krelage, Orange Favourite, Orange Wonder, Paris, Rose Copland, Wm. Copland.

3. Varieties where a reasonable percentage of bulbs can be expected to grow and flower normally:

   Allbright, Annie Laurie, Argo, Caledonia, Campfire, Carrara, Elmus, Fireside, Golden Age, Inglescombe Yellow, Kansas, King of the Reds, Korneforos, La Tulipe Noire, Princess Elisabeth, Princess Margaret Rose, Victoire D'Olveira, Yellow Giant, Wm. Pitt.

It is difficult to be more precise in compiling such a list, since the reaction of a particular variety to treatment appears to vary from season to season, and indeed from holding to holding within a season. It now seems likely that the pre-treatment storage which the bulbs received may have accounted for some of the variations.

Storage time and temperature

In 1956 it was noted at Kirton, in a small pilot trial, that bulbs which had a period of high-temperature storage before hot-water treatment grew better than those receiving low-temperature or normal storage. This has led to more exhaustive trials in an attempt to find the ideal time and temperature for pre-treatment storage. It is too early yet to give exact details, but several tentative conclusions can be drawn, taking into account the results of the experiments and also the few bulbs so far stored commercially before treatment.

The pre-treatment storage temperature should be around 80°F, but this temperature may not be critical. Good results have been obtained by storing the bulbs in a glasshouse where temperatures have been allowed to fluctuate from 70° to 90°F. The length of storage should be at least 14 and probably 21 days. It appears that the date of hot-water treatment is not so critical with correct storage beforehand, and this may mean that the period during which the bulbs may be treated safely can be prolonged. The bulbs may be cleaned and graded after storage but before hot-water treatment. The actual treatment should be immersion in hot water at 110°F, with the addition of a suitable wetting agent, for 2½ hours. In commercial conditions it is advisable to use a temperature of 110·5°F rather than 110°, to allow for possible variation in the bath. As always, post-treatment storage of the bulbs should be in good conditions and at a temperature suitable to the variety. The bulbs should be spread thinly in clean trays, and they need good air circulation. It seems reasonable to suppose that pre-treatment storage *at the correct temperatures* will lead to the successful and more widespread hot-water treatment of commercial tulip bulbs. Occasions have been noted where stocks have made better growth with treatment than without it.

A further method of control—the hot-air treatment—should also be mentioned, since it has been extensively practised for some years in south Lincolnshire. Basically it consists of putting the infested bulbs in a glasshouse from the time of lifting, and leaving them there, often until the time of planting. During this period the temperature is allowed to rise with sun heat to

well over 100°F for quite long periods. Some growers claim considerable success, but so far a complete control has never been achieved. This is probably due to eelworms in the pre-adult stage becoming dried up in the outside scale of the bulb, and so resisting treatment. A variation introduced to overcome this has been to put the bulbs in a store at 110°F for short periods, keeping the humidity as near to 100 per cent as possible. Even this does not give such good control as is obtained with the hot-water treatment.

What of the future? Apparently the pest is no longer spreading at the rate it was two or three years ago. It may even have reached equilibrium. Education has helped in the recognition of the symptoms, and the heavy losses suffered by some growers have made them all wary. Nevertheless the pest is now endemic in the tulip-growing areas, and an efficient, economic commercial control is essential. There is good reason to believe that this is on the way, and in time to prevent much good bulb soil from becoming contaminated.

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TORONTO WINTER FAIR SUCCESSES

British seed growers and merchants have again made their mark at the Royal Agricultural Winter Fair, held in Toronto from 13th to 21st November.

The World Championship for *Rye* went to Messrs. Brooks (Mistley) Ltd., of Manningtree, Essex, with a sample of their selected Giant Rye, for the second year running.

The World Championship for *Barley* was won by Lady Mary Delamere of Newmarket, Suffolk, with a sample of Earl Barley entered with Messrs. Brooks (Mistley) Ltd.

The Winter Wheat Championship was gained by Messrs. Gartons Ltd., Colchester, Essex, with a sample of their Victor II soft white winter wheat; and the Reserve Winter Wheat Championship went to Mr. J. V. Stock of Harwich with a sample of Eclipse soft red winter wheat.

Six first prizes for Yga hard red winter wheat, Cotswold broad red clover, Certified Kersey white clover, S.24 ryegrass, Feltham Advance peas, and Cheltenham Green Top Beetroot were also among the British gains.

Design of Horticultural Packing-sheds

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Mr. Green discusses not only the broad principles which should govern the design of a horticultural packing-shed, but also the details which will make it more comfortable to work in and better fitted to its purpose.

PACKING-SHEDS for horticultural produce may be classified broadly according to the type of crop they are intended to handle. There is the packing-shed that handles top fruit (apples and pears); the one that handles vegetables (including tomatoes, cucumbers, etc.); the type intended for flowers; and the general-purpose type not confined to any one kind of crop, but handling a number of crops at the same time or successively as they come in season.

The principles to be borne in mind by a grower and his architect or builder when planning a new horticultural packing-shed, or adapting an existing building, are discussed later. But at the outset it is as well to make a point—seldom fully appreciated, and giving rise to confused thinking—that whereas at first sight many packing-sheds appear to be large, complex and highly-specialized buildings, any one of them can in fact be looked at from three clear-cut aspects:

1. Work that is done in the shed.
2. Temperature-controlled chambers within or adjoining the shed (if any).
3. Main shell of the building.

It is not proposed to dwell on (2), because that is a subject in itself, which is dealt with fairly fully in the Ministry's Bulletins Nos. 159 *Refrigerated Stores for Fruit* and 84 *Apple Grading and Packing*. Nor is it proposed to go into any detail on (1), because in many cases the work that goes on in a shed varies not only from holding to holding, but also from season to season on the same holding. Moreover the modern trend of advice on the arrangement of equipment in packing-sheds is to have nothing permanently fixed, so that there may be complete freedom to rearrange the equipment at will, if a better assembly line is devised for handling one particular crop or if different assembly lines are needed on the same floor space for handling a succession of different crops.

It follows that the main shell of the building is what remains to be discussed, and that boils down *prima facie* to little more than a roof, four walls and a floor. But simple as that sounds, there is a certain amount of information which can be helpful when working out a design and, for a start, there are the following broad principles to bear in mind.

Principles of design

The length and breadth of the building will depend on the maximum amount of produce expected to be handled at any one time. Generally this

means a width of at least 18 feet and a length in multiples of 15 feet, which is the standard bay length of a modern, framed building—that is to say a building in which the roof is supported (by uprights) independently of the walls.

The best shape, for low cost per unit of floor space, is square; but for ease of working, a rectangle about twice as long as it is broad is usually to be preferred. A long, narrow building is not generally satisfactory. Both the short- and long-term views should be kept in mind. To erect a highly-specialized building is likely to prove short-sighted, and therefore it is well worth while to consider having an area of covered floor space clear of fixed partitions or other permanent fixtures. This will enable all the equipment inside the building to be moved, altered or rearranged to suit changing circumstances.

Another factor, which can seldom be foreseen at the outset, is whether it may be desirable at some future date to add more covered space. For that reason it is wise, if possible, to site a new packing-shed so that it can be extended—if not in all directions, then at least at one end or on one side.

The general layout of any well-designed packing-shed should include at least three fairly clearly defined sections, dealing with receipt, grading and packing, and dispatch of produce. Where produce has to be held for some time, another storage section will be required, and it may be necessary to set aside space to store empties as well.

The question of the machinery to be installed and its effective integration with the general plan for the building should be settled in good time.

There should be a point or points at which produce can be received into the shed without causing congestion, and a central or terminal point at which loading for dispatch takes place. Good layout will enable the produce to follow one or more smooth flow-lines from reception, through storage, grading and packing to dispatch, without any of the lines conflicting or showing gaps.

When choosing the site for a new packing-shed, or thinking of adapting an old building, the following points should be considered:

1. Convenience in relation to the glasshouses or land where the crops are grown.
2. Easy access to road dispatch.
3. Making effective use of any variations in ground level from the point of view of using gravity flow and ramps, to save labour and avoid unnecessary expense during building.
4. Ensuring adequate falls for drainage from the site.
5. Provision of water and electricity, both of which are nearly always essential.
6. Amount of exposure to or shelter from sun and wind.

Points in construction

The type of building usually found to be suitable for use as a packing-shed has brick walls, preferably of cavity construction, a pitched roof covered with asbestos-cement sheeting, and a concrete floor. The height to eaves may be 8–16 feet, according to the scale of the enterprise and the need to allow lorries to drive in and out. Windows, roof lights and doors are included as required. A small office for the foreman is situated in one corner, and there may be partitions to sub-divide the floor area if more than one kind of

produce is to be handled at the same time. Most of the grading and packing equipment in the building is movable so that it can be altered or rearranged without difficulty. The roof and lights may have to be protected against birds flying in and out. Where the building is to be small and there is no question of driving vehicles in and out of it, doors (either hinged or sliding) about 6 feet 6 inches high are suitable. But where the building is large, and lorries are to drive in, at least one very high door is needed. A clearance of 12 feet from threshold to lintel is desirable for a lorry loaded with produce for market, and even 14 feet may be essential if clearance is needed for a load of empties. Doors of such great heights and widths should be hung on slides, not hinges; or it may be better to use roller shutters instead.

There should be plenty of windows in the walls of all parts of a packing-shed where work is done, particularly over lengths of benching. They should face north rather than south to avoid the glare and heat of the sun in summer. Hopper-type windows that open inwards at the top are the most suitable, because they also act as draught-free ventilators. In a large building, the windows should be supplemented with north-facing roof lights, either of glass or transparent plastic.

Electric lamps should be fixed or hung so that they take the place of the windows and roof lights after dark, or so that there is ample light to promote efficiency and to avoid accidents. All wiring should be properly earthed and made waterproof.

Stale air should be removed by ventilation outlets or extractors in the walls or roof. It is not necessary to have special air inlets in the walls, because quite enough fresh air enters through doors, even when they are closed. Conditions inside the building are likely to be very cold in winter and very hot in summer. This is due to the types of material of which packing-sheds are usually made, the omission of insulation of the walls and roof because of the heavy cost, and the large volume of air in the building which it is difficult to warm up or cool down.

Extreme conditions are bad, both for the workers and for the produce, and steps should be taken to see that there is some insulation or shading of walls and roof, a fan or fans for ventilation in hot weather, and some form of heating for cold weather. It may not be necessary or practicable to apply these measures to the whole building; for example, the space heating of a large packing-shed may be uneconomic, quite apart from its adverse effects on the produce. If part of the building is enclosed by partitions and these measures are applied to that part only, what is required may perhaps be achieved more readily and cheaply. Alternatively, it may be just as effective to arrange heating in relation to the workers' position in the building, so that they feel more comfortable without the temperature being raised appreciably in the building as a whole.

The inclusion of lavatory accommodation in the scheme should be considered, and this is another reason why the installation of drainage should be contemplated when choosing the site.

The protection of empties and other packing material is often an economic proposition, since it decreases the rapid rate of deterioration. Consequently some growers provide special shedding for this purpose, or under-roof storage in the packing-shed. An alternative sometimes used is to sheet over stacks of empties in the open.

Sources of further information

As mentioned earlier, two Ministry Bulletins are of interest to the grower of top fruit seeking information on the buildings that will serve his enterprise. Bulletin No. 84 *Apple Grading and Packing* goes into detail on the types of packing-shed most suited to his needs.

Bulletin No. 159 *Refrigerated Stores for Fruit* describes the types and methods of construction of cold stores and gas stores that are often needed in conjunction with packing-sheds. A third Bulletin, No. 115 *Construction and Heating of Commercial Glasshouses*, contains a section on the type of packing-shed suitable for a glasshouse enterprise.

Fixed Equipment of the Farm Leaflet No. 35 *Ventilation and Insulation*, although primarily intended for those concerned with the housing of livestock, contains information equally applicable to buildings, such as packing-sheds, in which people work.

A new Fixed Equipment of the Farm leaflet (No. 44) dealing with the design of horticultural packing-sheds will be available at the beginning of April. Single copies may be obtained, free, on application to any of the Ministry's offices.

Finally, it should not be forgotten that the nearest Divisional Officer of the Ministry will give any grower (or his architect) free advice on the design of any particular packing-shed he is thinking of putting up.

Report on Crop Drying

TOM BILLINGTON

There was some lively debating for and against flail harvesters at the Green Crop Driers' Tenth Annual Convention. Other subjects discussed ranged from irrigation to pale-yolked eggs.

PROCEEDINGS at the convention of the Association of Green Crop Driers, held on November 16–17th at Eastbourne, ranged over a wide field—from discussions on the earthworm, flail harvesters, irrigation, research programmes and suggestions for a new approach to assessing the feeding value of dried grass, to that abomination of the housewife, the egg with a pale, sickly-coloured yolk.

On the subject of the earthworm, MR. STANLEY KERRIDGE (British Air Transport Ltd., Redhill) said that worm casts were so plentiful that they caused an excessive soil content in his green crops for drying, and he wondered whether it might become necessary to de-worm the pastures, as was done with bowling greens. But LT.-COL. H. W. SALMON (Langham, Colchester) was opposed to this idea. He maintained that worms were beneficial to the soil structure—so much so that in America special farms were producing worms for sale by the thousand. He thought that flail harvesters sometimes caused an excessive soil content in the green material, but to some extent this depended upon the sward or soil under the crop being cut

For and against the flail harvester

Although Col. Salmon had some good things to say about the flail harvester, he was not wholly in favour of it from a grass drier's point of view. He thought that the material it produced was not ideal for either high- or low-temperature driers. On the other hand, it was a very useful implement to have, because it could occasionally save the labour of one man in the field by blowing the material straight on to the trailer, thus offsetting to some extent the lower output to the driers.

This view, in turn, was strongly challenged by MR. D. H. STEED (Sudbury, Suffolk) who was full of praise for the flail. In the drought of 1959, his fields had been so burnt up that it looked as though there was nothing to cut at all. When he put the flail harvester on them, however, he was astonished at the amount of material which this very useful machine recovered. It was, in fact, almost entirely due to the flail harvester that he had been able to honour his contracts for dried grass during this particularly dry summer.

It was the paper read by MR. J. H. W. WILDER (John Wilder Ltd.) which gave rise to this discussion. Mr. Wilder said that the flail harvester had made an almost sensational impact on the harvesting of grass for silage. He did not consider it to be the complete answer for the grass drier, although it might be suitable for part of the season and very useful in assisting in the management of grass. He said that British farmers were first able to buy this machine in 1957, and yet within the six months January to June 1959 a total of over 4,000 forage harvesters (the majority being of the flail type) were sold in the United Kingdom. In 1957 only two manufacturers were supplying these machines, but today the farmer could choose from about fifteen different models being supplied by eleven manufacturers. The flail had already opened up new possibilities in grassland farming in this country, and was likely to have a profound effect on tropical farming.

More tractor speeds

MR. W. H. CASHMORE, Director of the National Institute of Agricultural Engineering, who presided over this session, spoke of the versatility of flail harvesters and of the many uses to which they could be put. But he thought we needed further experience with them before we could fully assess their value. To get the highest efficiency from these machines, it was obvious that some of our modern tractors still had not enough special speeds. He thought that as we became more specialized, we should like eight or ten forward speeds or, better still, hydraulic transmission, because more people wanted to relate tractor speeds to the conditions, and in these cases the conditions had to be quite exact to get the best results.

MR. R. E. GOLDSMITH, in his paper on the harvesting of green crops for high-temperature drying, spoke of his experience with British Field Products Ltd. in drying grass over a period of many years around Walsingham, Norfolk. He said that between 1952 and 1959 the better use of mechanization and the improvements made on machines had led to a saving of 29 per cent in wage-rate paid hours, despite an increase of 45 per cent in wage rates over the same period.

Many changes had been made in the firm's equipment during the nine

working seasons including and since 1951. The eventual capital cost of re-equipping the field machinery would be around £15,000; the original equipment cost £24,000 in 1951. The company would now have a maximum of eighteen land wheels, apart from transport wheels, in use on harvesting machines at any given time, compared with 121 in their first year of working.

Commenting on Mr. Goldsmith's paper, Mr. Cashmore said that a most important point had been brought out—the necessity for reliability in machines. He wished manufacturers and farmers could get together on this point. Machines should be available which were more reliable without adding to their cost.

Opening the convention, SIR RICHARD HADDON had said that at one time he, among others, thought grass drying was merely a war-time job, but the product of dried grass had proved that it had a "mystery" value of its own. He paid tribute to the Association for their determination to carry out research into the full value of dried grass as a feed for livestock.

In his presidential address, MR. R. O. DAVIES commended the response of members of the Association to the Council's appeal for funds for a research programme. Over £3,000 had been subscribed. This was indeed pleasing, but a greater sum was required, and steps must be taken to get it.

Speaking of the publicity which had recently been given to eggs with pale yolks, he said that the feeding of a ration containing dried grass was, without doubt, the answer to this problem.

Irrigation

The subject of irrigation was introduced by Mr. Kerridge and by MR. J. R. FELL (Oxon-le-Fields, Darlington) whose farm is largely irrigated by sewage effluent. He said that the estimated amount of sewage effluent being wasted every day was sufficient to irrigate at least 150,000 acres, a very conservative figure which could probably be multiplied by three.

The fact that there was rarely any relationship between crude protein content and digestibility was referred to in the paper read by PROFESSOR J. D. IVINS (Nottingham University). In trials that he had recently carried out, he found that among samples of dried grass and lucerne of different protein contents, lucerne proved to be less digestible than grass, and lucerne with a crude protein content of 18·9 per cent was even less digestible than that of 16 per cent.

Describing his drying plant at Westbury, Northants, MR. MERRICK OWEN said that among his problems was that of getting the grass fed completely evenly into the mill. His suggestion that this might be solved by milling in series was thought by manufacturers who took part in the discussion to have some possibility of success, although the technique needed further investigation.

Farming Cameo: Series 2

21. Winchester District

G. W. WOODROW, B.SC.
District Advisory Officer

SOMETHING akin to a miniature is implied by "farming cameo", and this is a very fitting description of the Winchester district considered in relation to the county of Hampshire as a whole. Lying diagonally across the centre of the county, it has no very distinctive natural boundaries, and is defined rather by the parishes already existing in the county. It has its quota of high, dry chalk land in its northern part, and runs down to the Tertiary soils of the Hampshire basin to the south. To the south-west, its border takes in the fringe of the New Forest and a share of the ponies and cattle wandering there.

The major farming area is, of course, on the chalk so typical of Hampshire as a whole, and so much sought after today. Traditionally a barley and hurdled sheep country, with farms running down to the limited water-meadow area along the clear, fast, chalk streams, the area entered the war and post-war expansion era in not very good shape. The most numerous livestock were rabbits, which required no fences or piped water.

This open, unfenced countryside lent itself ideally to the new highly-mechanized farming which was developing, and barley is still by far the most important cash crop, often handled in bulk, and dried and stored by the growers on their own farms.

Along with the barley growers were the followers of Hosier's ideas on low-cost milk production; the mild winters, and the freedom from drainage problems on the chalk, allow all-the-year-round stocking of the leys which have become the pre-requisite of the barley crop since the hurdled flocks disappeared.

A suitable climate, the need to rest land in grass yet the desire to avoid the capital costs involved in fencing and watering large areas, have all contributed to the development of another very specialized aspect of grassland farming in this area, herbage seed production. By a suitable choice of varieties, S.24 perennial ryegrass being a popular one, the expensive harvesting equipment of the corn-growing farm can be used over a much longer season on a crop which is just as much a cash crop as the corn for which it prepares. Fertilizer usage on the seed-growing farms is probably as heavy as anywhere in the country, and one has to admit that with little and in some cases no stock, farms (many in the 1,000-acre class) show maintained and improved fertility by the high yields of corn, mostly spring varieties, which are achieved.

One must not give the impression that this is a low stock region, however, for not only are there rare exponents of the art of barley growing, but also of the intensive use of grassland for dairy herds. An outdoor bail is by no means synonymous with extensive farming in this area; rather is it a way of getting at the land to manage it more intensively. Alongside the dairy cow

are more and more flocks of grassland ewes, which allow that last finesse in grassland management.

In the valleys of the Test and Itchen, which run southwards through the district, stiff with fabulous trout, there was a highly-developed system of water-meadows operated by a skilled labour force. Few of these men remain today, and even fewer farmers who can afford to maintain such "drowning" systems in operation.

The greatly developed amenity value of the trout fishing in these valleys has also had its effect on the water-meadows, by maintaining unduly high water levels (and probably offering a more remunerative income in depressed times). Consequently, although regions of great beauty and a source of much pleasure, these river valleys are perhaps the least satisfactorily farmed in the district.

However, the pioneering spirit which seems so inherent among Hampshire farmers has got to work here, particularly since the advent of the rotavator, which has allowed the cultivation of the densely-matted meadows without the need to invert this weight-bearing mat with the plough. Pioneer crops of Italian ryegrass allow the gradual levelling and firming of the land which, in time, can be seeded down to very productive long leys. Consolidation is the big problem here, as it is for other reasons on the dry chalk soils of the downs. A really heavy set of rolls will always fetch a good price at a farm sale in the Winchester area.

Moving down stream with the Test and Itchen to the salmon reaches, we leave the chalk and enter an area of very varied soils, where all the problems which one avoids on the chalk now loom large. Heavy clays with impeded drainage, areas of acid gravel, the problems relating to the use of old gravel workings, and spreading urban areas, all tend to take the gloss off the farming picture until one arrives at Southampton, the farms getting smaller and showing some horticultural bias as one goes. It is in this southern end of the district, around the little agricultural town of Romsey, that the Small Farmer Scheme has had its greatest impact. This is where one finds the small but intensive grassland farms, devoted almost entirely to dairy farming, and often relying on the New Forest area, which they border, for the supply of hardy dairy replacements, with a strong leaning towards the Channel Island breeds. Here is an increasing tendency to spare the land in winter, and to develop systems for housing the cattle in covered yards, with parlours where herd sizes are growing, or still in the cowshed where these relatively expensive buildings already exist. There are many covered silo-barns with supplies of straw, cheaply bought here from the corn-growing neighbours just up county, stacked on top of the silage up to the eaves. Since the break-up of many larger estates under the pressure of urban development, many of the small farmers are owner-occupiers and the silo subsidy has been of great assistance to them, for "landlord's capital" is not easily set aside for such improvements on the small farm.

There is one other product, very typical of Hampshire, which has not yet been mentioned—watercress. Many a tea table has to thank the Alresford growers for a fine product, something that is of the very essence of Hampshire, reminding us of temperate waters flowing in swift chalk streams through the downs to the big cities of the south coast, where the consumers' diet benefits considerably.

Smithfield 1959

GEORGE JARRETT
Clevedon, Somerset

SMITHFIELD has the great advantage over the summer shows of being held when farming is more or less settled into a winter routine, and not subject to interruption by either hay or corn harvest. Taking place in London just when the scintillating Christmas decorations add to the gaiety of life, the show beckons the farmer and his family for a much-needed break combining business with pleasure. The farming year would be bleaker if the Smithfield Show were to be omitted.

The highlight of Smithfield is of course the beef championships. Sincere congratulations are due to all concerned with the two great Aberdeen-Angus successes. Although the champion "Prince Merger" came from a Scottish breed, it was bred in Sussex and exhibited by the breeders, the Wych Cross Estates. This southern success in the championship was counterbalanced by the winning of the reserve championship by another Aberdeen-Angus, 19-month-old "Idamit of Kinermony", but this time bred and exhibited by Messrs. J. Sainsbury Ltd., from Kinermony Home Farm in Banffshire. We lesser mortals can only stand and admire the products of a great breed and the skill of devoted stockmen.

In the Devon classes, the breed championship went to Mr. A. E. Payne's "Lufton Cherry 108th", a heifer which has been right through the summer shows with considerable success. This championship brought to her breeder the honour of having won the breed championship five years in succession at Birmingham and, in the same years, four championships and one reserve championship at Smithfield. I understand that it has never been known for a Devon breeder to win this championship so many times in succession: Mr. Payne certainly earns our congratulations. His winning heifer has been described as an outstanding example of a Devon. Since Mr. Payne became a member of the Devon Cattle Breeders' Society in 1954, he has done immeasurable good for this great breed by his many successes.

Placed reserve to Mr. Payne's heifer both at Birmingham and Smithfield was Mr. W. T. Baker's "Nynehead Controller", a baby steer from another Devon herd which has achieved many successes in a short time. The Devons well maintained the honour of the breed at Smithfield.

There was a new judging competition this year. Four teams of three, representing stockmen, breeders, butchers and scientists, had to place the live beef animals in the order they would occupy as carcasses. The scientists won, the breeders were second, the butchers third and stockmen fourth. The highest personal score was made by Mr. E. L. Jones, Director of the Experimental Husbandry Farm at Rosemaund.

I have a more personal interest in the sheep, because of my own efforts at fat lamb production. I should have liked to have seen a bigger entry of Devon Closewools which, when crossed with the Southdown or the Dorset Down, produce a type of lamb that is very popular both in London and in the

West Country. A butcher to whom I sell will travel nearly a hundred miles to buy my lambs from this type of crossing. Although he always says that those he has just bought are too light or too dear, he always returns for more!

The Southdown seems to come in for a certain amount of criticism at times, but it is a breed which I just cannot help liking. Next year I hope to include a Southdown ram in my crossing programme on the Devon Close-wool, to produce again what one farmer describes as "lambs having a leg at each corner"!

Although we all look admiringly at the livestock entries—and Smithfield certainly would not be the same without them—it is really the carcass classes which are the ultimate aim. In the grimmer days of war, we were glad to get that extra bit of meat without caring anything about breed, weight or colour! That was one extreme. Are we in danger of going too far the other way in trying to suit the consumer? He—or she—may be frightened at the thought of a bit of fat, but are we doing enough to show a post-war generation of housewives what flavour in meat really means?

As we wander from livestock to machinery stands and back again, our thoughts are never allowed to follow an orderly sequence. I have not missed a show since the war, and one development makes a very strong impression on me. We are now producing some really good machines. For a while I had the feeling that in the machinery world "anything was good enough for the farmer". Obviously the farmer has made it clear that this attitude is not good enough, and the overall picture today is encouraging and satisfying. We are the most highly mechanized country in the world, and our exports of agricultural machinery are soaring. And how many of the new, improved machines which we saw are necessary only because of the better crops that we are able to grow? The most efficient combine is useless if we lack the grain to harvest; likewise the trend towards forage harvesters is interlinked with the heavy crops being grown on modern ley mixtures, adequately fertilized. We owe much to the plant breeders, fertilizer manufacturers, and the leading seed firms of the country, whose work gives us more productive cereals, earlier and more profitable and palatable leys, and better methods of grassland management.

Looking down on the ground floor, watching the crowd mill around the machinery and the livestock, impresses the real grandeur of the show upon the observer. This is the show as everyone sees it, but what lies behind it? Some tribute is certainly due to those who work behind the scenes, both before the Smithfield curtain rises and after it is lowered for the last time. A chance conversation brought me the information that the Secretary, Mr. J. G. Yardley, O.B.E., supported by a staff of about eight young ladies, starts to prepare the next show in March, pausing only to vary the recipe as a result of experience and the keen ear which is kept open for constructive criticism. Even last-minute foot-and-mouth disease threats this year did not upset the organizing staff. Perhaps I may take the liberty, on behalf of visitors and exhibitors, of saying thank you most sincerely to those who do the routine work of putting on such a splendid show, which presents the best of British livestock and machinery to the world.

At the Farmers' Club

Horticultural Marketing

THE Minister of Agriculture, the Rt. Hon. John Hare, O.B.E., M.P., spoke to the Farmers' Club on 2nd December about the Government's plan for horticulture. Explaining the background to the plan, he said: "We must continually keep in mind the enormous diversity of types and methods of production, of variation in the capital and facilities employed, and of the scale of business enterprise in horticulture. Otherwise we could produce pipe dreams with no resemblance to reality."

Horticultural marketing is a very complex business. Many different products are involved, some competing with each other, some highly perishable; and the supply and demand for them cannot be accurately predicted. Some can be marketed locally by the grower; others have to be carried long distances and must pass through the hands of middlemen. Imported and home produce have to be brought together in the shops—we import about half our total consumption of horticultural products—and the housewife expects a very wide choice of goods and prices.

"All sections of the industry have a close and common interest in ensuring that produce reaches the consumer with the least possible delay, damage and wastage. The best efforts of producers to put better produce on the market will obviously be nullified if that produce is badly handled in the course of distribution, or in the shop. Full use will not be made of better transport, handling, and market facilities, until there are changes in producers' techniques in packing and preparing their produce. And the retailer, however hard he tries to attract custom, will be wasting his time if the only goods he has to offer have lost their freshness and bloom."

The Government accepts the obligation to secure a reasonable measure of stability for British growers, said the Minister, and they will use the tariff as their main instrument. The proposals in the recent White Paper on Horticulture* are not a substitute nor a replacement for the tariff: they are intended to improve the present structure of marketing and distribution, and include some entirely new features. They fall into three parts, each of which, though capable of standing by itself, would be incomplete without the others.

The first is to help producers by capital grants to improve the presentation of their produce for market. Legislation now before Parliament provides for these grants under a new Horticulture Improvement Scheme, to help the grower market his produce in the quantities and at the times required by the market, in the condition that attracts the customer, and as economically as possible. Grants will help to provide the buildings and equipment needed for proper preparation and packing of produce for market; and for other long-term improvements. A list of the many different kinds of item which will be eligible for grants can be found in the White Paper.

* Cmnd. 880. H.M. Stationery Office, price 9*d*. (11*d*. by post). See also *Improvement of Horticultural Production and Marketing* in the December 1959 issue of this JOURNAL.

Many horticultural businesses do not provide a reasonable livelihood on their own and, after careful consideration, it has been decided that the new grants will be available only to growers with more than four acres of open land (or an equivalent, smaller area under glass or equipped with other special facilities). But steps are being taken to help the small men: for example, co-operative marketing can be of particular benefit to them, and some grants under the Scheme will be available to growers' marketing co-operatives. There will also be grants to assist growers to modernize existing glasshouse heating systems, and to help those with between 4–7 acres of land to install a limited area of glass, primarily for propagation purposes.

The Scheme is not in general designed to aid production, but is concerned mainly with what happens after the crops have been harvested. It will give assistance for certain machinery and equipment, as well as buildings, needed for storage and preparation of produce for market. Long-term improvements, such as packing-sheds, may qualify for grants even when they are not on land forming part of a horticultural holding. (This may happen when, for instance, they are provided through a co-operative.)

Not all the criteria used in the Farm Improvement Scheme are applicable here. The test of whether an improvement proposal is worth while will be the relationship between the cost of carrying it out and the benefit that it will bring to the efficiency of the business.

In all this the Government are thinking of business efficiency, and in this context, the Minister said, "I would like to mention the special provision for grants to central co-operative organizations. Grants will be made for programmes of activities such as recruiting and training managers for new co-operatives, or the provision of consultancy services like those employed by other large businesses. This entirely new form of assistance is an important complement to the grants available to co-operatives for improving their physical facilities for marketing members' produce."

The Scheme will involve new work for the Government's advisory staff, especially for horticultural advisory officers who have not so far been involved in other grant schemes, such as the Small Farmer and Farm Improvement Schemes. But the Scheme's introduction will add special point to existing contacts between advisory officers and growers, and should not diminish the value derived by the industry as a whole from the work of the advisory staff.

"In formulating these proposals," said Mr. Hare, "we have not been able always to look to previous experience, but they are based on sound principles. I believe that they will give real help to the industry to improve its competitive position."

The second object of the Government's plan is to provide machinery for bringing all sections of the industry together to make improvements throughout the whole chain of marketing and distribution. A Horticultural Marketing Council will be set up, on which producers, wholesalers and importers and retailers will be equally represented; other members will represent organized labour, and others will be people from right outside the industry. If the present pattern of trading should change, it may be thought desirable to alter the composition of the Council, and this will be possible.

The Council itself will have no power to trade, or to regulate the trading of others. It will be concerned rather with research—finding out just what

the consumer wants, for example: with promotion—it will be able to undertake general advertising of horticultural produce: and with education—for instance, it will be empowered to formulate standards for produce and for containers, and will encourage their adoption. It will have no power of enforcement. For the first two years, the Council will be financed from public funds; after that, it will be paid for by the industry.

If growers want it, a special organization can be set up to promote sales of home-grown produce. (The Council itself will be concerned with all horticultural products sold in Britain, whether home-grown or imported.)

The Government's third aim is to improve the London wholesale markets, which have a special part to play in the efficient distribution of horticultural produce. The operation of Covent Garden—so congested that it "is almost a miracle that it works at all"—will be made the responsibility of a Covent Garden Market Authority. This body will be given the job of concentrating the market into a more compact area, and of reorganizing it so as to relieve the appalling congestion. Later, after consulting the trade and market users, and the L.C.C. as planning authority, the Authority will rebuild the Market on modern lines.

Major developments at any one of the London markets are likely to affect the others. A London Horticultural Markets Consultative Committee will therefore be set up, on which owners and traders from all the London markets can discuss and advise on changes to, or development of, any of the markets.

"This, then, is how the three parts of our plan are interrelated. In the first place we shall help growers to improve their marketing. The Horticultural Marketing Council will take on from there with the task of improving distribution between the holding and the shop. Finally, we shall remove the brake which antiquated marketing conditions have put on improvements elsewhere."

A. M. Richardson

Change of address

On 25th January, the Ministry's Publications Distribution Section will move from Soho Square to Ruskin Avenue, Kew, Surrey. All applications for leaflets and inquiries about the Ministry's publications should thereafter be sent to that address.

THE MINISTRY'S PUBLICATIONS

Since the list published in the December 1959 number of AGRICULTURE (p. 420) the following publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable from Government Bookshops or through any bookseller at the price quoted.

BULLETINS

No. 77. Tomatoes (*Revised*) 5*s.* 6*d.* (5*s.* 11*d.* by post). This new edition has been completely rewritten in the light of recent experimental work and commercial experience. It includes sections on varieties, situation and soil, cultivation operations under glass and pest and disease control.

No. 100. Diseases of Bees (*Revised*) 4*s.* (4*s.* 4*d.* by post)

OTHER PUBLICATIONS

Farm Incomes in England and Wales, 1957–8. Farm Incomes Series 11. Report based on the Farm Management Survey (*New*) 6*s.* 6*d.* (6*s.* 11*d.* by post)

LEAFLETS

Up to six single copies of Animal Health Leaflets may be obtained free on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 2d. (4d. by post).

ANIMAL HEALTH LEAFLET

No. 49. Hypomagnesaemia (*New*)

FIXED EQUIPMENT OF THE FARM LEAFLET

No. 38. Farm Buildings—Floor Construction (*New*) 1*s.* (1*s.* 2*d.* by post)

One free copy of Horticultural Machinery Leaflets may be obtained on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 6d. (8d. by post).

HORTICULTURAL MACHINERY LEAFLET

No. 3. The Low Level Sprinkler Irrigation System for Use Under Glass (*New*) 6*d.* (8*d.* by post)

FREE ISSUES

Obtainable only from the Ministry (Publications), Soho Square, London, W.1.

UNNUMBERED LEAFLETS

Code of Clean Milk Practice (*Revised*)

Silo Subsidies Scheme (*Revised*)

At the Farmer's Service (*Revised*). Contains brief summaries of the various grants, subsidies and services offered by the Ministry, the Forestry Commission, the various marketing boards and other organizations which exist to help the farmer.

Copies can be obtained from the Ministry's Divisional Offices or from the address above.

In Brief

PLANTS ATTACKED BY FIRE BLIGHT

Fire blight is a highly-destructive disease of pears and apples, caused by the bacterium *Erwinia amylovora*, which was first identified in England in 1958. It was probably introduced into this country from abroad about 1956, and has caused severe losses of trees in some pear orchards in Kent. A general account of the disease, and of the campaign undertaken by the Ministry in an attempt to eradicate it, was given in the February 1959 issue of this JOURNAL (pp. 564–8).

Until this year, fire blight had been found only on pear in this country, although it is known on a wide range of rosaceous hosts in N. America. Intensive efforts towards eradication this year have uncovered its existence on hawthorn (*Crataegus* spp.), whitebeam (*Sorbus aria*), rowan (*S. aucuparia*) and *Cotoneaster* spp. including *C. salicifolia*, *C. melanocarpa* and *C. polyanthema*, mainly in gardens and parks in Southend-on-Sea, Essex, Croydon, and the southern and south-eastern suburbs of Greater London. It has not been found on apple, one of the hosts severely attacked in the U.S.A.

Of the many plants known to be affected by fire blight in other countries, only those in the sub-family *Pomoideae* are more than slightly damaged by the disease, or will support it through the winter. The members of the *Pomoideae* native to, or grown in, Britain are the common quince (*Cydonia oblonga*), medlar (*Mespilus germanica*), hawthorn and other *Crataegus* spp.; pear, including the wild and species pears (*Pyrus* spp.), apple in its wild and cultivated forms (*Malus* spp.); *Sorbus* spp., of which rowan, whitebeam and the service tree (*S. torminalis*) are the commonest representatives, and shrubs of the genera *Cotoneaster*, *Pyracantha*, *Chaenomeles*, *Amelanchier* and *Raphiolepsis*. Fire blight is likely to be found on any of these, causing a blossom wilt and die-back of spurs, shoots and branches.

R. A. Lelliott

SIR RICHARD MANKTELOW

As from 1st January, Sir Richard Manktelow, K.B.E., C.B., is being succeeded as one of the Deputy Secretaries in the Ministry of Agriculture, Fisheries and Food, by Mr. G. S. Bishop, C.B., O.B.E. Until he finally retires from the public service at the end of March, Sir Richard will be engaged on special duties.

BLEDISLOE GOLD MEDAL

Her Majesty the Queen Mother presented the Bledisloe Gold Medal for Landowners to Capt. G. L. Bennett Evans at the Annual General Meeting of the Royal Agricultural Society of England last month. This medal, which is awarded under a trust fund set up by the first Viscount Bledisloe, is given for outstanding service in encouraging the application of science or technology to some branch of British husbandry. The award of this medal to Capt. Bennett Evans, Her Majesty said, recognized his outstanding contribution to the technical developments of reclaiming upland pastures on the slopes of Plinlimmon, which is an example and encouragement to all hill farmers.

Behind that statement, as many readers of this JOURNAL will know, lies a long history of painstaking experiment, accurate observation and careful recording, as well as an ardent faith in the possibilities of improved pastures on unproductive

hills. Not only has he been a pioneer in ploughing and reseeding, but he has also shown courage in keeping cattle on the hills all the year round for the purpose of improving hill pastures for sheep by "treading". He has shown vision and perspicacity in his efforts to apply fertilizers from the air and in planting belts of trees for shelter. The results are shown in the increased numbers and improved quality of his flocks and herds. These and the indoor wintering of sheep (using slatted floors), and the establishment of a valuable pedigree herd of hardy Welsh Black cattle, are all parts of the technique which have brought him success and the present award. It will be recalled that in 1957 the Royal Welsh Agricultural Society awarded the "Bryner Jones" trophy to Capt. Bennett Evans, the first such award ever to be made, for his outstanding services to Welsh agriculture.

LAND DRAINAGE IN ENGLAND AND WALES

The Minister of Agriculture has put forward proposals to improve land drainage in England and Wales, based on principles agreed with the River Boards' Association, the National Farmers' Union, the Country Landowners' Association and the Association of Drainage Authorities. Both proposals and principles are set out in a White Paper, Cmnd. 916.*

Under the new proposals, river boards will be able to levy drainage charges on agricultural land, and use the money on the more important intermediate watercourses (between private ditches and publicly controlled channels) and for additional work on main rivers.

The boards will be able to extend their land drainage responsibilities, if they so wish, in two ways:

1. By levying a general drainage charge on all agricultural land outside internal drainage districts, in which drainage rates are already levied. Through this charge farmers would make about the same contribution as the general ratepayers through the rates for land drainage in the area concerned.
2. By levying a special charge, where the river board can establish that there is an agricultural need for extra drainage work. The money from this will be reserved for work on selected watercourses; the river board's scheme will need the Minister's approval.

The two charges together must not exceed 1*s.* in the £ on the gross annual value for Schedule A purposes—about £4 10*s.* per 100 acres of average land.

These proposals will not in any way supersede the present law relating to internal drainage boards, which can still be set up.

Some watercourses will remain outside the scope of any drainage authority. There will still be room for action by private individuals and, in some cases, local authorities. The laws dealing with local improvement schemes promoted in co-operation with owners and occupiers, and those dealing with the powers of local authorities to prevent local flooding, will be reinforced. Steps will also be taken to strengthen the position of occupiers in dealing with neglected ditches on neighbouring land.

LORD NETHERTHORPE RELINQUISHES N.F.U. PRESIDENCY

Lord Netherthorpe, President of the National Farmers' Union by annual election for the past fourteen years, has decided not to seek re-election. First as James Turner and later as Sir James, he has ascended the farming ladder rung by rung from secretary of the Worksop branch to the top. By his influence and unflagging zeal for the well-being of British agriculture, he has promoted the strength and importance of the National Farmers' Union beyond the wildest dreams of the

* H.M. Stationery Office, price 1*s.* (by post 1*s.* 2*d.*).

nine farmers who, one wet day at Harmston Park in Lincolnshire fifty-one years ago, conceived the idea of farmers banding together to protect their interests. The great organization as it stands today looks with pride and affection upon the years when the signature set below its activities was "Jim Turner".

AGRICULTURE IN THE NINETEENTH CENTURY

The British Agricultural History Society held its annual winter conference, in co-operation with the Association of Agriculture, last month. It met in London under the chairmanship of its newly-elected president, SIR KEITH MURRAY. Sir James Scott Watson retired this year after having been president since the Society's inception in 1953.

MR. T. W. FLETCHER, of the Department of Agricultural Economics, Manchester University, gave a paper on Lancashire livestock farming in the great depression. Mr. Fletcher, whose views on the farming history of the last thirty years of the nineteenth century are rather revolutionary, showed that the livestock farmers of Lancashire did not, in fact, suffer. On the contrary, their standards of output, purchase of imported concentrates and other feedingstuffs, as well as their incomes, improved because demand was rising, both locally and in the West Riding industrial districts. It is not surprising that rents were well paid and stable, and that relations between landowners and tenants were amicable.

The afternoon session was opened by MR. O. R. MCGREGOR, Reader in Social Institutions, University of London, with a paper on free trade in land in the Victorian period. Mr. McGregor argued that for the nineteenth century, at any rate, the study of the social institutions surrounding farming was more important than the study of technical changes. He emphasized the conflict between the rising class of urban industrialists and the small number of great landowners who were striving to retain their dominance of the political scene, and the prestige and patronage that went with it. The landowners, who used every possible device to prevent the break-up of estates, regarding the land not so much as a rent- or food-producing commodity, but as a possession of social value. This outlook coloured their relations with their tenants, whom they wished to keep in mercy as tenants-at-will, and their attitude towards the increasingly wealthy and pugnacious middle classes who demanded free trade in land. It was significant that so many members of the House of Commons, not to speak of the House of Lords, before 1870 were landowners and land agents. This lecture certainly provided a new approach to the problems of farming history in the nineteenth century.

Finally, MISS EDITH WHETHAM, Gilbey Lecturer in the History and Economics of Agriculture, University of Cambridge, discussed Cambridgeshire tithe maps, 1836–90. She said that because the country was backward in 1836, these maps give a fine illustration of the change from open to enclosed fields in many parishes.

G. E. Fussell

BORON

Two new very useful leaflets about boron deficiency—its recognition and correction—have been published by Borax Consolidated Ltd. Copies are free on application to Borax House, Carlisle Place, London, S.W.1.

Book Reviews

Scottish Farming, Past and Present. J. A. SYMON. Oliver and Boyd. 42*s*.

Here is the most painstaking account of Scottish agricultural history so far available. The reference material, relating to earlier times at least, is scattered far and wide and has been largely neglected by most non-agricultural historians. Readers will note with gratitude the immense amount of energy which Colonel Symon has consequently put into his book.

The chapters which bring the story up to the mid-eighteenth century should perhaps be reviewed by a historian, but even an agriculturist will learn much about the influence of feudalism and the Church on farm practice. It is revealing, for example, to read of the extent to which, in the fifteenth and sixteenth centuries, the nearness of famine caused the State to try to enforce maximum food production and limit food consumption by enactments, some of which are extraordinarily reminiscent of measures taken in the two world wars; of agriculture being the main export industry around 1600; and of poverty and ill-nourishment being so acute, as late as the beginning of the eighteenth century, that the dying were said sometimes to have reduced their demands on the less fortunate living by crawling unaided towards the churchyard! In this section of the book, those interested in land tenure can ponder on cottar and tackman; rack-rent and grassum; thirlage and herezelde; steelbow and mortuary; casualty and calpa; run-rig and enclosure; feu and wadset.

From 1750 onwards, the focus becomes sharper. Scotland's very late start and its subsequent astonishing progress are made clear. A country relying on sledges rather than wheels, and still farming in the mentality of outfield and infield until well into the eighteenth century, was by the end of that period exporting both ideas and farm managers, and proceeding with a special brand of northern ruthlessness with enclosure, consolidation of holdings, tree planting and the conversion of the subtenant and small farmer to the landless, paid worker. This late but uninhibited start gave Scottish farming in the nineteenth and early twentieth centuries a name with which to conjure. Could it be that, on the historical seesaw, we find England, less advanced in 1939, once again the readier to change and advance?

There are competent accounts of wartime food production, the work of the Department of Agriculture for Scotland, agricultural education, livestock improvement and land settlement. Throughout, the reader will be impressed by the great attention to detail, the meticulous documentation of every piece of factual information, and the willingness to stray into the English agricultural scene where this helps to elucidate developments in Scotland.

D.S.H.

Agricultural Law and Tenant Right (5th Edition). N. E. MUSTOE and RAYMOND H. WOOD. Estates Gazette. 105*s*.

The fifth edition of this well-known work completes the trio of books on these subjects which are to be found, sometimes singly but often together, on the bookshelves of solicitors, surveyors, land agents and valuers. It follows the form of the fourth edition, devoting about half its 1,072 pages to law and tenant right and the remainder to acts and statutory instruments. This combination is very convenient, as the text is copiously cross-referenced to lead the reader to the act or instrument from which a particular point of law is derived. There is also an extensive case index.

The preface reminds us that since 1949 there have been more than twenty statutes directly concerned with, and confined to, agriculture, besides others concerned with marketing and those only partly concerned with agriculture. This is a useful measure of the importance of agriculture in our economy today.

Unavoidably, in dealing with a subject so far-reaching as agricultural law, as distinct from the consideration of the Agriculture Acts and the Agricultural Holdings Act, the text must be kept short, and Mr. Mustoe has trimmed his words most effectively to the great benefit of the reader. In

this way the book is more of a guide: it expounds clearly and briefly what the law is and, by cross-references, points the way to acts and orders and decided cases which will give the reader the detail if he wants it.

But this gives rise to mild criticism in a few instances. On page 58, for example, reference is made to the power of the Minister of Agriculture to give directions to secure farm production in the national interest. It would have been helpful to the general reader to be told that no directions are in force at the time of publication. Similarly, on page 65, which deals with the Minister's powers to control the sub-division of farms, a note could have drawn attention to the fact that no Order has yet been made under Section 86 (7) of the Agriculture Act, 1947.

It is a notable lack that there is nothing in the text dealing with statutory smallholdings; a book bearing the title which this has must be adjudged incomplete without it. Perhaps a future edition will remedy this defect.

Mr. Wood deals with tenant right in that clear business-like manner to which we have become accustomed. Like his co-author, he wastes no words yet misses no points. For the first time there is no reference to custom in assessing compensation, and one feels that the efforts of legislators ten years ago to get rid of customary compensation are now bearing fruit.

C.R.

Modern Humus Farming. FRIEND SYKES. Faber and Faber. 28*s*.

Can one farm successfully today without using artificial fertilizers, fungicides, insecticides, hormone sprays, herbicides and the whole vast armoury that modern chemistry has put into our hands? When we read of Australian fruit-growers who are now applying twenty-two sprayings a year to their apple orchards and thinking it nothing out of the way; and of orange groves where the bill for spraying comes to £685 an acre, or 2*s*. 9*d*. per bushel excluding labour, it seems quite pertinent to ask ourselves where we are going.

It is possible to farm without these chemical aids, and there are a number of people doing so without a tinge of regret for their departure from orthodoxy. Mr. Friend Sykes is one of the best known of them. He farms 750 acres on the chalk at Chantry, in Wiltshire, and this new book, while containing some text already printed in his other works, reviews the further experience of ten more years of this kind of farming. We find that the experience has fortified and clinched his earlier tenets, which had to be personal convictions rather than proved theories when he embarked upon his pioneering path.

Mr. Sykes is the complete egotist, and so his manner at times as an author can be more than a little irritating. Those who hate the whole idea will find this a good excuse for putting the book down. But, if they are genuine seekers after knowledge, they will be ill-advised to do so. For here is no dreamy idealist. He is as keen to see a good reward for his work as the next farmer. As one of those with the longest experience of farming in this way, he describes how he does it. In fifty years' time the pros and cons of "organic farming" will probably still be matter for argument. There may well be a place for stimulants and drugs in dealing with a farm not in perfect health, just as for human beings, and it might be as narrow-minded to "sign the pledge" and say you will never use an ounce of sulphate of ammonia again as to do the same with whisky. But to pretend that no one can farm successfully without chemical aids has become demonstrably untrue, and it is time that more people realized it. They could not make a better start in bringing their knowledge up to date than by reading this book.

L.E.

Royal Botanic Gardens, Kew: An Illustrated Guide (3rd Edition). H.M. Stationery Office. 2*s*. 6*d*. (2*s*. 11*d*. by post).

In this third edition of the illustrated guide to Kew Gardens, the opportunity has been taken to bring up to date, where necessary, the nomenclature of plants, and other information of a more general nature.

The section on the museums has been rearranged, since the Orangery (formerly Museum III) has now been restored to its former use. The function of Museum III (formerly Museum IV) has been changed to that of a general wood museum and the description of the exhibits has, consequently, been completely rewritten.

D.M.C.

Beef Cattle Husbandry (2nd Edition). ALLAN FRASER. Crosby Lockwood. 21*s*.

In this edition, the author has rewritten the chapter on marketing, modified others and added a new one on scientific progress. He follows the established practice of researchers in assembling, in each chapter, the available evidence and sources; he then gives us his own conclusions, and/or the apparent conclusions of beef producers, often perforce leaving the issues open. The book is well illustrated and, of course, very readable.

Centuries of trade have given us all some appreciation of the laws of supply and demand, but, as the chapter on marketing shows, they are of dubious value in a world of state control where the word "price" has dual components; and "demand" has often to be written in the plural. The historical approach to the problem, here adopted, makes the tale comprehensible, if not entirely consistent.

He discusses the characteristics of all our native beef and dual-purpose breeds, adds a few words on certain foreigners, then examines practice in rearing and feeding. Outstanding in the breeds section is the chapter on Shorthorns, with its tale of migration to Scotland, its triumphs abroad and return to, or near to, its homeland. Small wonder, in view of its record, that the author is critical of colour marking *per se*. Not that he is a blind partisan of the Shorthorn. His frequent citations of William M'Combie of Tillyfour amount almost to adoration of the genius who virtually made the Aberdeen-Angus. Outstanding too is his chapter on beef from hill and marginal land; here he is literally on home ground.

Strangely, though there is a voluminous literature on the Highland "clearances", there are no actual records of numbers of men or their cattle dispossessed. We cannot profitably argue from history what numbers the Highlands *could* carry, but, from the known present-day averages, the author concludes that the hills of Britain could produce over 450,000 calves annually; although, in Scotland, a sizeable slice of the hay crop would be needed to winter the cows.

The potentialities of our dairy herds, probably twice as great as those of the hill stocks, are also difficult to assess. Innumerable genetic, nutritional and economic problems are involved. The author sets these out fairly enough, giving his own views on their meaning, often inviting controversy. (Not everyone would agree that selling milk is an easier job than rearing calves!) As to the feeding process, he reaches much the same conclusions as others—not much in it in winter, but a modest return from grass.

W.B.M.

Farmer and Stock-Breeder Year Book and Desk Diary, 1960. Farmer and Stock-Breeder, Dorset House, Stamford Street, London, S.E.1. 20*s*.

There will be the usual warm annual welcome for the imposing *Farmer and Stock-Breeder Year Book*, now in its eighty-fourth year of publication. Those who, like myself, have proved its value over a number of years, will already have their copy, but for newcomers it may be said they will find it of unparalleled usefulness and interest. Its size is $11\frac{1}{4} \times 8\frac{1}{2}$ inches, and it is $\frac{1}{4}$ inch thick—too large to be misplaced. In fifty pages, comprising the Farm Records Section, there is provision for most of the memorabilia which the "office life" of farmers increasingly requires. The Diary Section of 45 pages is likely to be ample for the diurnal jottings of all except those of inveterate prolixity; and to ensure that no farmer is idle for long, marginal suggestions for topical farm work have thoughtfully been provided. Then there is the Reference Section and Index, of 125 pages, which allows of no excuse for ignorance on a multitude of subjects and authorities. But probably the first thing to catch the eye will be the pedigree livestock and machinery pictures which delight, whilst evoking the sin of envy.

S.R.O'H.

Efficient Use of Fertilizers. (F.A.O. Agricultural Studies, No. 43.) Edited by VLADIMIR IGNATIEFF and HAROLD J. PAGE. F.A.O. Rome. H.M. Stationery Office, London. 22*s*. 6*d*. (23*s*. 2*d*. by post).

In its new, revised and expanded form, this book is more valuable and important than ever, and the editors are to be congratulated on their achievement. Their purpose and scope are stated modestly enough: "It is not an exhaustive treatise,

nor is it a detailed handbook of complete recommendations for particular local areas. Rather, it has a different purpose: to help those who plan and execute agricultural programmes, and to help agricultural advisers, teachers and students all over the world to spread the available knowledge about fertilizers and their use for crop production."

The subject is certainly not an easy one to handle on a world-wide basis: soils, climates, cropping systems, the economic means of crop producers—these and other factors vary so widely. To this extent the general treatment, chapter by chapter, might be considered a handicap to the book's influence: but careful study shows that the difficulties have been substantially overcome.

The present text is more than twice as long as the original of 1949; the number of expert contributors has risen to 96 and they represent 34 countries. The treatment of the purposes and methods of fertilizer use is considerably fuller, and more attention is also paid to economic aspects. Much additional experimental data from the post-war period is usefully cited, and an entirely new chapter deals with the needs of crops. There is also considerable discussion of different countries' methods of encouraging greater understanding and use of fertilizers.

In short, the modernization and expansion of the book have greatly enhanced its practical helpfulness, and it is a superb work of reference. Tribute must be paid to the quality of its presentation and the clarity and coherence of its writing. In these days when technical books are often expensive, this one is very reasonably priced, and excellent value.

G.C.

Some Aspects of Agricultural Research. H.M. Stationery Office. 3*s.* 6*d.* (3*s.* 11*d.* by post).

This booklet is a reprint of the articles appearing in the *Report of the Agricultural Research Council for the Year 1957–58*, following a decision "to present, in a form suitable for general reading, a series of articles, each of which would cover a selected topic within the sphere of agricultural research".

No one will grumble at this decision. On all sides there is a constant clamour that the results of research should be transmitted with maximum efficiency to the husbandman. Without detracting from the technical merit of the articles it may be argued whether the object of the booklet has been achieved. The material covers a wide range of subjects, both in livestock and crop production. Unfortunately, the style of writing and presentation varies a great deal.

"Fertilizer Placement Investigations" is a model of the kind of exposition which caters for the widest range of interest: farmers, technical experts, students and, not to stretch a point, the layman who wishes to know what dividend the nation gets from the public funds spent on agricultural research. After a brief description of early attempts at placing fertilizer, there are lucid reviews of the experimental work on cereals, potatoes, other row crops, and herbage crops, together with a note on E. W. Russell's work on ploughing-in fertilizers. The final section in this article, "The practical application of fertilizer placement research", indicates the extent to which farmers have made good use of placement techniques once the tools for the job have been perfected.

The other articles are, in varying degrees, more specialized in their interest. The exhaustive survey of poultry research covers problems of genetics, reproduction, disease, nutrition, housing and management, as well as marketing. No one can fail to appreciate the vigour with which workers are tackling problems as diverse as the emergence of strains of bacteria resistant to antibiotics and the influence of light on the laying bird.

The booklet is invaluable for all who are associated professionally with agricultural research and advisory work, and it will be of great assistance to students in describing the state of present knowledge and indicating the range of opportunities in agricultural research. What is doubtful is its impact on the audience to which it is addressed—the general reader. It would have been easier for him to follow the story had a liberal use of side headings been adopted and, where necessary, technical terms defined; "haemorrhagic syndrome", for example, is not in everyone's vocabulary.

"Correct placement . . . is essential if the best returns are to be obtained from fertilizer dressings." Much the same principle also applies to the dissemination of information.

J.H.C.

Types of Farming in Yorkshire. (University of Leeds Department of Agriculture, Economics Section, Farmers' Report No. 143.) 3*s*.

Part I of this report is a study of capital investment by tenants and owner-occupiers during the last six years, and Part II contains the usual tables, without commentary, showing the organization and financial results for a sample of 244 farms in Yorkshire for 1957–58.

The authors are to be congratulated for selecting a specific, and highly topical, subject for detailed study. Too often the text of these reports is merely a repetition of what the tables already show clearly enough. In Part I Mr. C. J. Black questions the value, under present conditions, of the traditional separation of landlord and tenant, and shows that the rate of capital investment on owner-occupied farms considerably exceeds that on tenanted farms. He admits that "pride of ownership had encouraged the owner-farmers to spend more than was strictly necessary", and notes with some surprise that the incomes on the tenanted farms had kept about on a par with those of the owner-occupiers. Nevertheless, few would disagree with his conclusion that capital must constantly be replaced if efficient farming is to continue, and the lower rate of investment on the tenanted farms will tell in the long run.

The tables in Part II are clear and comprehensive, but the reader will search in vain for a list of definitions covering such terms as "Profit", "Social Output" and "Net Surplus". This is a serious omission and should be put right in future reports.

B.E.C.

Forestry and the Town School. Forestry Commission.

Capture interest, and the sharpening of wits and the shaping of knowledge will follow. How successfully interest was stimulated, and education and forestry served, is shown by this account of a sensible and satisfying project carried through with great thoroughness, yet well within the scope of the ten- to eleven-year-olds for whom it was designed.

In the Woolwich school which undertook the venture, it served as a focal point for many studies and activities. Thus all subjects received the benefit of the interest stimulated by the forestry study scheme, which occupied a whole school year. Although it was pioneered by the top class of a junior school, it would give seniors, with their special woodwork rooms, an added incentive for their studies. They could follow the lines laid down in the booklet, but to a more advanced stage.

This well-presented, well-illustrated booklet is a helpful guide to teachers and, despite its title, country schools would also find it a profitable guide to tree study. Such studies, fostering an understanding and love of trees, bring home to children the nationally important work being carried on by the Forestry Commission, and so make them aware of their national heritage. For junior children, especially in urban or suburban populations, studies like this awaken interests which are far beyond the classroom or the park, and make them feel responsibly related, as junior citizens, to the men who serve the nation's forests.

Copies of this booklet are obtainable free from the Forestry Commission, 25 Savile Row, London, W.1.

A.S.

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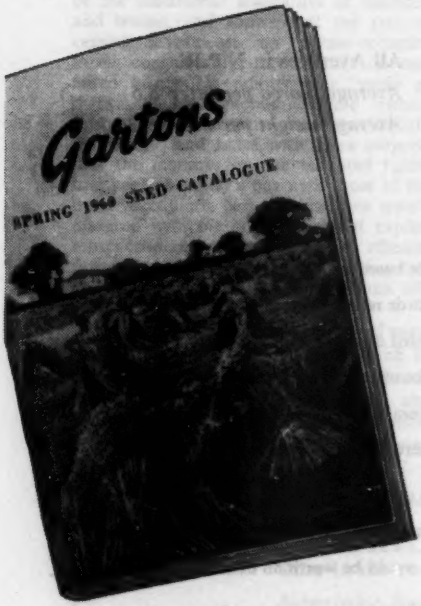

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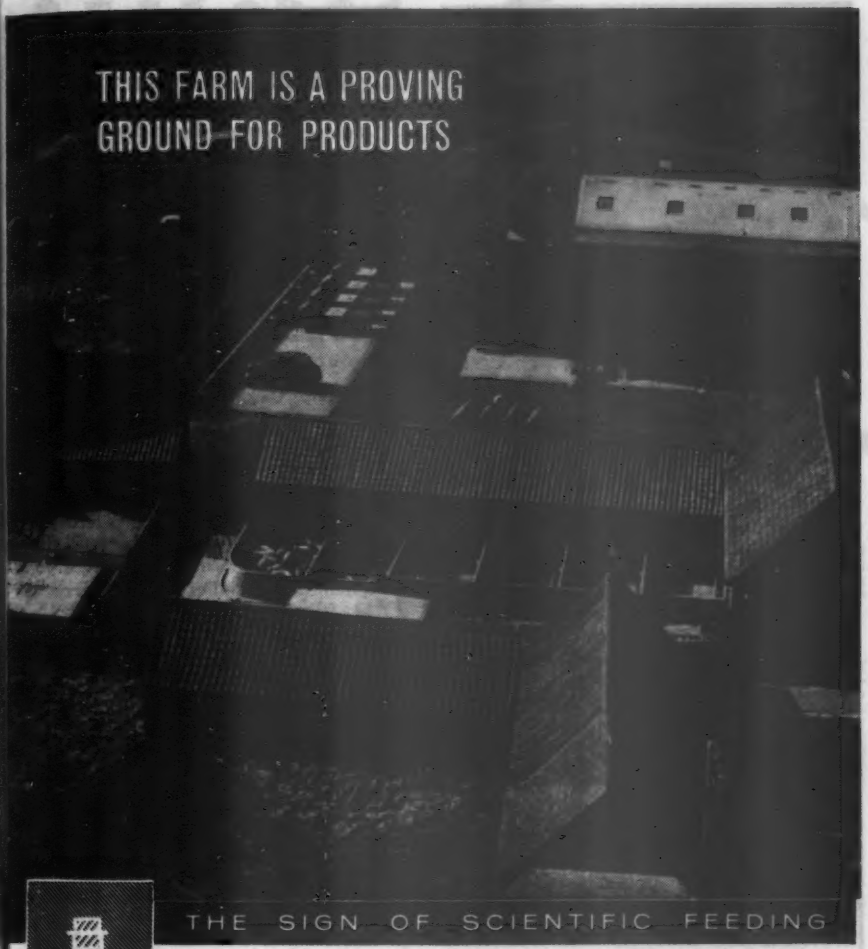

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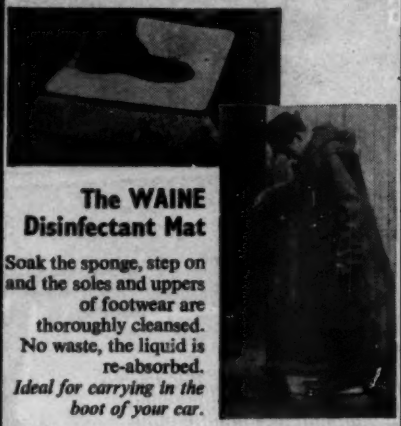

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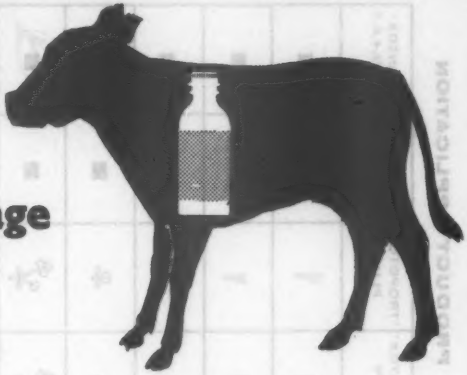
HUSK

immunisation prevents lung damage that no treatment can repair



So far no fully satisfactory treatment for husk has been found. Drugs may reduce the effects of the disease but are powerless to prevent or repair the early damage started by the larvae *before the animal even coughs. Prevention* is the only sure way of avoiding losses from lungworm infection. *Prevention* is what immunisation with Dictol Lungworm (Oral) Vaccine offers you now as the only practical and economical way of keeping husk from your farm. For extensive trials have proved that immunisation with Dictol not only prevents outbreaks of the disease but protects the animals' lungs from the initial attack of the larvae as well. Only Dictol can give you such a complete safeguard against lungworm infection.

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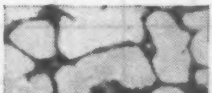
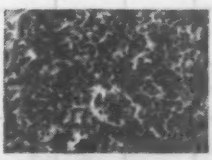
WHAT "HUSK-FREE" WITH DICTOL IMMUNISATION REALLY MEANS:



Lung of healthy animal
Cross section of part of a lung of a healthy animal, immunised with Dictol. Notice the clear air spaces which allow the lung to work properly.



Lung of husky animal
Cross section of part of a lung of a husky animal. The cell structure of the lung is damaged by the larvae beyond repair. Drugs can kill adult worms that later clog the bronchial tubes but they cannot prevent or make good this damage. Only Dictol can safeguard your cattle from this.

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OATS	■	■	■	■	■	■	POST HARVEST	■
CEREALS undersown with CLOVERS	■	■	■	■	■	■	■	■
Direct seeded LEYS	■	■	■	■	■	■	■	■
PEAS	■	■	■	■	■	■	PRE-SOWING	■
LUCERNE	■	■	■	■	■	■	■	■
CEREALS undersown with SAINFOIN	■	■	■	■	■	■	■	■
Young LEYS	■	■	■	■	■	SPRING AND EARLY SUMMER	■	■
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